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THE SPHENOID ON PARADE.*

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I am inviting you to make a journey; to go back to the early days of civilization, and join me there, in a leisurely trip through the years with the sphenoid sinus on parade, and me as dragoman, until we return to station 1935. Each step of the way is full of interest, but there will be time for but highlights, as we journey on.

To save time, we visit only interesting areas of sphenoid sinus history, and the stations will be divided into epochs. The first from B.C. to A.D. 1880, and from then on, 10-year periods to each epoch.

At our first stop 3500 B.C., we are introduced to an Egyptian physician, by the name of Sukhet Enanck, who waited on King Sahura of the Fifth Dynasty and "made his nostrils well;" so we classify him as the first rhinologist. In the Orient, 3100 B.C., we find a good knowledge of anatomy, and during the Chow Dynasty, 1122 to 250 B.C., diseases were classified according to seasons of the year; headache and neuralgia, were known as spring affections, but no doubt, sphenoid infection played a part. The Greek historian, Herodotus, tells us medicine was practiced by physicians who treated a single disease, and only that, some treating eyes, others the head and others, teeth.

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Hippocrates, 420 B.C., was the first known specialist listed in history. Herophilus, his pupil, was a great anatomist at the Alexandrian school. Claudius Galen, in A.D. 131, is the first to give a description of the nose; he refers only to the porosity of the bones of the head which caused the head to be light. He makes no mention of sinuses. The first to do so is Berengar del Carpi, a teacher at Bologna, in the Sixteenth Century. It seems very strange that so many years should pass from the first mention of anatomical study, B.C. up to the Sixteenth Century, without recognizing the sinus cavities. In 1515, Vesalius describes the maxillary, frontal and sphenoid sinuses as containing nothing but air.

Now comes a long jaunt to the second stop of this journey; we must travel for three centuries to make a brief pause in 1871, while Rouge entertains us with the history of a case and its postmortem findings in which the sphenoid sinus was filled with hard caseous pus. It is the first known case of sphenoid disease and not diagnosed until after death.

We must hie away for nine years to the next stop or Epoch 2, beginning with the year 1880 to 1890. In this important epoch are featured the men who fostered and handed down to us their valuable work on anatomy, disease and treatment of the sphenoid. These men, now to be introduced, have illuminated the way to our present knowledge of sphenoid disease.

The work of Zuckerkandl, beginning 1882 and closely followed by Onodi, informs us of the details and relations of surrounding structures of the sphenoid; next in line is Killian, and after him others of note. In 1884 Morell Mackenzie, of London, published a text on nose and throat which required about 12 years to complete and in which no reference is made to sinus disease, but which contains the following lines on page 237: "The superior meatus is limited by the upper and middle turbinated bones and by that portion of the external wall included between them; it communicates by means of foramen with the posterior ethmoidal cells and through them with the sinuses in the body of the sphenoid." On page 362, he speaks of areas from which polypi grow, listing 39 cases, one of which occured at the ostium of the sphenoid. In 1882 Bosworth mentions reports of ozena due to disease of the accessory sinuses, but he does not concur in this belief.

Berger and Tyrman, in 1886, published the first work on diseases of the sphenoid and ethmoid. After searching ancient and modern literature, they relate that affections of this region are rare. Schaeffer, in 1885, reports the first case of sphenoid sinus disease in the living. In the latter part of this epoch Rolland reports a case, dilatation of the sphenoid sinus from accumulation of retention of fluid and obstruction of posterior nasal fossae. He tells of an opening that was made in the left side in the lower part with an electric motor from which only aqueous liquid flowed, but pain disappeared and the patient improved.

Let us move on to Era 3, 1890 to 1900, and spend a few moments with our confreres, Jansen, Schaeffer, Onodi, Knapp, Holmes, Kyle, Bosworth and others. Jansen advocates enter-

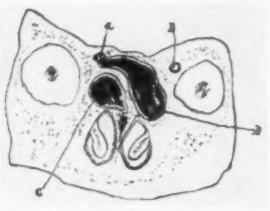

Fig. 1. (a) Left optic nerve. (b) Right optic nerve. (c) Left sphenoid. (d) Right sphenoid.

Fig. 2. Hooded burr taking down anterior wall of sphenoid.

ing the sphenoid sinus by way of the canine fossae through the maxillary sinus, destroying the posterior ethmoid cells to gain access to the sphenoid. Schaeffer reports many cases of chronic inflammation of the sphenoid sinus with symptoms of fetor, dizziness, supraorbital neuralgia, stiff neck and general pressure of the head or occiput. Pain may be intermittent and may produce nausea or vomiting. He never finds eye troubles. Holmes says that Collier, for years a teacher of anatomy in the London Hospital, made the statement that in many cases the sphenoid cells have no communication whatever with the upper meatus of the nose, only with the posterior ethmoid sinuses. Bosworth states that Zuckerkandl found, in rare instances, instead of two lateral sinuses, a horizontal plate dividing the cavities. The upper cavity opened directly into

the ethmoid cells and the lower one opened into the nasal fossae. A greater anomaly is where the anterior wall is entirely wanting, the cells opening directly into the ethmoid sinuses.

Zuckerkandl advises opening the sphenoid by way of the nasal cavity, passing a trocar along the septum and at its anterior dependent portion.

In 1896 we find the X-ray making its first appearance as an aid in diagnosing sinus disease. Max Scheier, of Frankford, shows this X-ray; the outlines of the sinuses are scarcely visible but sufficient to prove the future value of the X-ray as a diagnostic adjunct.

Farber suggests puncturing the sphenoid sinus near median line, almost against the vomer and one-fourth inch above where inferior border of the vomer articulates with the sphenoid. He says that fortunately this cavity is not frequently diseased. The text of Kyle states that diseases of the sphenoid are difficult to diagnose.

Let us now scuttle to Period 4, 1900 to 1910. The sphenoid is beginning to come into its own. Custer quotes as follows, from a new book on nose and throat by Shurly: "It is claimed by some rhinologists that the sphenoid can be opened through the nares by drilling through the body of the sphenoid bone. I quite agree with Bosworth in questioning the accomplishment of the result from this direction, although it has been reported done in many instances."

Samuel Lodge, Jr., reports a case of meningitis following an abscess of the sphenoid, diagnosed at autopsy. Oscar Dodd reports an interesting case of sphenoid sinus infection on which a mastoid operation was done because of pain over the mastoid; a postmortem made the diagnosis. Beaman Douglas states that Zuckerkandl and Hajek speak of the body of the sphenoid bone as a modified vertebral body presenting all the characteristics possessed by a vertebra. It is modified, however, so as to make it a cranial bone. They state further, that in early child life the nasal mucous membrane projects into the sphenoid bone. Grunwald says that sphenoid sinus disease is hard to diagnose and rarely occurs *per se*, but is usually secondary to ethmoid disease. Holmes advocates the use of peroxide of hydrogen and claims Grunwald has had good

results with pure carbolic acid followed by simple irrigations, in sphenoid suppurations. David McKeown states that the treatment of chronic suppuration of the sphenoid ranges itself under three headings. First, irrigation and insufflation of powders. Second, breaking down of anterior wall and curetting cavity. Third, extending operation by removing part of floor.

Myles tells us that disease of the sphenoid sinus is more easily diagnosed than diseases of other sinuses and treatment more satisfactory. Coakley stands prominently in the foreground in the early making of sphenoid history. He concedes difficulty in diagnosing sphenoid disease because of the sinus location and expounds upon the anatomical structures border-

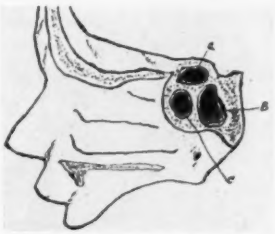

Fig. 3. (a) Posterior ethmoid. (b) Sphenoid sinus. (c) Optic nerve. (d) Internal carotid. (e) Vidian canal.
Fig. 4. (a) Posterior ethmoid cell. (b) Right sphenoid. (c) Left sphenoid.

ing this cavity and the involvement of important areas; which results in varied symptoms.

Coakley shows the first X-ray of sinuses in America and is active in developing its usefulness as an aid in diagnosing sinus disease, but states it is of little value in sphenoid work. Oppikofer tells us in his anatomical study he finds the sphenoids absent four times on both sides and once on one side. Mosher gives a profound discourse on the anatomy of the sphenoid which is clear and comprehensive as to the sphenoids' relation to surrounding structures.

Berens does not know to whom he should give credit as priority for operations on the sphenoid through the maxillary route, but considers it a good method in certain types of disease and reports 14 cases. He advises against this pro-

cedure unless the maxillary is diseased. Holbrook Curtis states the size of ostea is 2 to 3 mm. vertical and 1 to 2 mm. transverse, and also that he was the first to open the sphenoid through its natural ostea, by using a barrel dental drill with probe point.

Logan Turner tells us he is still groping about in the dark as to the best method of attacking the sphenoid. Canfield quotes Jansen as saying if a sinus is affected on one side all are more or less affected. Wells advocates opening the sphenoid through the intranasal route, breaking down the anterior wall and curetting the interior, under general anesthesia. He places a finger in the nasopharynx to guide his instrument. Myles in one instance ligates the external carotid for hemorrhage from the sphenoid. Hajek finds that diagnosis becomes more difficult not from lack of knowledge, but with increased knowledge; and that diagnosis can be made certain only by temporary plugging of the orifice for 24 hours; if pus is found on the anterior surface of the plug, a diagnosis of posterior ethmoid can be made, but if pus be on the posterior surface, there is disease in the sinus.

Jules Laboure discusses ways of attacking the sinus. First, by the lateral aspect, in resecting the zygomatic arch, but it is a long process, complicated and dangerous. Second, by the nasopharyngeal aspect. Third, by the orbitoethmoidal route, maxillary route and nasal route. Guisez considers that the orbital route should be followed where there is inflammation in the orbit or where a rupture of the lamina papyracea has occurred. St. Clair Thomson expresses his views on diagnosing this sinus disease and dogmatically states it is the most difficult of all sinus disease to diagnose. He reports 17 failures in a series of 42 in which patients died of intracranial complications. Hays demonstrates a new light, the pharyngoscope.

We will now go forward to Epoch 5, 1910 to 1920, to spend a little time with Syme, Watson-Williams, Holmes, Sluder, Loeb, Jos. Beck and others. Syme tells us he examined 240 skulls with reference to the sphenoid, as to their size and form; stating that these sizes varied from a rudimentary cavity, to a large cavity of one and three-eighths inches deep, to one inch wide and one and one-fourth inches high; no skull was without sphenoid cavities. The distance from the anterior

nasal spine to the ostea varied from two and one-eighth to two and three-fourths inches. In large sinuses they extend behind and above its fellow. He found only two which were behind and below its fellow. In one skull was a large right sinus with no ostea and in two the ostea was in the sphenoethmoidal cell.

Holmes is expounding on an instrument he calls the naso-pharyngoscope.

Watson-Williams in a bilateral sphenoid suppuration removed one-half inch of the posterior part of the septum in its upper area, corresponding to the sphenoid rostrum and also takes away the sphenoid sinus septum to form a single

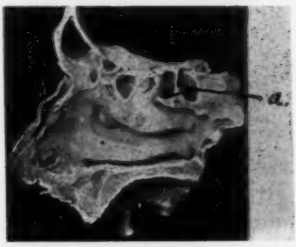

Fig. 5. (a) Large sphenoid.
Fig. 6. (a) Sphenoid sinus.

sinus cavity; he insists upon removing the anterior wall of the sinus first.

Heller, Chiari and Voislowsky all report cases of foreign bodies in the sphenoid sinus. Kuhn goes by way of the mouth to reach the sphenoid, making an incision through the mucous membrane of the hard plate, far back, chiseling off some of the hard palate of the vomer and of the pterygoid process and pushing the soft palate backward into the pharynx; he evacuates the sphenoid and stitches the displaced portion back in place. He has operated two cases sucessfully. Loeb tells us of the cubical capacity and superficial area of the sphenoid. He made plaster casts of 20 subjects which gave a clear idea of the size, form, variety and irregular contour of the sinus, the average being from 0.6 to 11.8.

Grayson relates his method of making an exploratory opening into the sphenoid. He shrinks with adrenaline and anesthetizes with cocaine, paints the surface with a little dilute iodine solution, takes a straight drill with a conical burr 6 mm. long, applies it 3 mm. above the base and close to the septum, and when the opening is made he bites out the desired area. He was criticized severely. Roe told him it was not difficult to find the natural opening.

Beck tells us of a few histological findings in sphenoid disease. Sluder entertains us with his description of a definite symptom complex which is dependent upon an irritation of the nasal ganglion and its branches. Inflammation of the sinus may produce many symptoms depending upon the relation of the cavernous sinus, IIIrd, IVth, VIth Vidian and optic nerves. He attributes many cases of migraine to sphenoid infection. The typical symptoms of sphenoid disease are as follows: Stabbing pain in the upper jaw and behind the eye; below the zygomatic process and in the ear with relation to neck and shoulder. He also speaks of the sphenoid in its connection with the Eustachian tube and its possible clinical importance, for which idea he claims priority.

Bryan speaks of a case of earache without abnormal ear findings which was caused by disease of the mucous membrane of the sphenoid, due to reflex pain radiating through the nasal ganglion, Vidian nerve and the otitic ganglion. Andrews displayed a probe, knife and cannula for exploring and enlarging the ostea and for irrigating the sphenoids.

Oppenheimer tells of the great value of the pharyngoscope in children and believes he would have failed to diagnose many cases of sphenoid sinus disease without it.

Myers is demonstrating two cases having diverticula of the mucous membrane of the sphenoid, protruding directly into the subdural space; any manipulation would probably prove fatal.

Beck is speaking on five new diagnostic symptoms of sphenoid sinus disease and says of all the sinuses the sphenoid undoubtedly gives the best results following operation, since this means nothing more than to drop the bottom out of the cavity. He has a stereoscopic photograph of a specimen in which the internal carotid artery can be seen without bony

covering. He has given much thought to the method of diagnosing such anomalous conditions when curetting the sinus is necessary. He takes a flat end probe and presses gently in different areas, when a pulsation is felt or probe moves synchronously with pulse, the presence of an exposed artery or vascular tumor is indicated. Arterial pulsation was observed in two cases, which he thinks was due to syphilitic necrosis of the sphenoid bone rather than to an anomalous finding since pulsation ceased following antiluetic treatment. The first symptom he records is pulsation in the region of the sphenoid opening which can always be seen by postrhinoscopic examination. The second sign of necrosing of the sinus wall is the distension of the cavernous sinus by artificial and alternate compression of the internal jugular veins producing a swelling of the lining membrane of this sinus. If pus is pres-

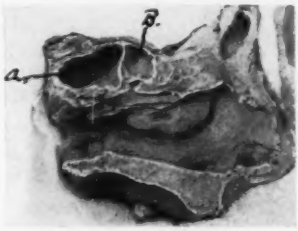

Fig. 7. (a) Posterior ethmoid. (b) Sphenoid sinus.
Fig. 8. (a) Sphenoid sinus. (b) Posterior ethmoid.

ent it will be seen welling out of the sinus on compressing both internal jugular veins. The discharge will recede when the veins of the neck are released. The third sign is based upon palpation, percussion and auscultation; the curette is tapped against the bone and a sound is elicited which differs from that resulting when a partition remains. Sense of touch aids greatly in determining pathology. The percussion note of the solid part of the sphenoid differs in sex as well as voice. The fourth sign is pupillary changes when the sphenoid is involved. When the cavernous plexus is irritated it will produce a small, even a pin point pupil, if paralyzed a dilatation will occur which may be on one or both sides. Fifth sign, an alternating exophthalmos from retrobulbar venous plexus becoming dis-

tended as a result of the irritation of the cavernous and carotid plexus and produced by the sphenoid infection.

Our next station is Epoch 6, 1920 to 1930. We will alight for an interview with Baum, who tells us that ocular manifestations can be due to disease of the sinus of the opposite side. Dan Mackenzie says the absence of any sign of disease inside the nose is not sufficient to exclude sinusitis from the diagnosis. Van der Hoeve says it cannot be known with certainty that sinus affections do or do not exist in a given case. Long and Pollock speak of a pulsating sphenoid. Segura tells his procedure for opening the sphenoid by doing a typical submucous resection, removing the middle and upper parts of the septum and rostrum sphenoidale and also removing the anterior and lower wall of the sphenoid. The mucous membrane of the anterior wall is elevated laterally and cut along the choanal insertion, tamponed upon the curetted mucous membrane of the sphenoid on the operated side. After septum heals, the opening thus made, remains open.

Bergen tells us he studied the literature regarding brain abscesses in 176 cases and only one was due to sphenoid sinus disease. Lejeune gives a clear demonstration of the embryology of the sinus. Druss finds the absence of both sphenoids in a case and believes few brain abscesses are secondary to diseases of this sinus. According to Barlow, the sphenoid is often neglected due to lack of anatomical knowledge. Lynch does not believe in doing all sinus cases by the external route, but when all sinuses on the same side are involved the sphenoid can be reached by his method.

Proetz is speaking in reference to displacement irrigation of the nasal sinuses and its importance in diagnosis; following him Fraser expounds on the same subject. We find Sewell talking of cytological examination and its value in diagnosis of infection in the nasal accessory sinuses.

Our next stop is in a new era not yet written, for this is the beginning of another day, but let us pause to pay our respects to those who began it, to hear their stories and see their vision. Oaks and Merrill explain a sphenoid sinus syndrome, a posterior pain, vertigo and tinnitus and advocate making note of these signs; they claim relief by sphenoid lavage. Costen gives relief to a patient suffering from right

sided headache by resecting the left sphenoid. He speaks of anatomical variations of the sphenoid sinus and quotes Onodi as showing frequent influences of one sphenoid cell upon the disease of both optic nerves, and that he, Onodi, had collected a number of cadaver specimens of unusual morphologic arrangement of sinuses; and had observed dehiscences in the septal wall of the sphenoid. He also quotes Zuckerkandl and Hajek as describing specimens with total absence of the sphenoid septal wall. He quotes Sluder as stating that when a clear picture of the sphenoid sinus disease was present he resected the sphenoid sinus on the opposite side when operation on the indicated side failed. Carter makes it positive that operative measures in acute sinusitis are not to be considered, except in extreme cases, as the dangers of meningitis and pyemia are great.

Kistner and Eggleston entertain us with interesting discussions regarding their findings in vascular and perivascular changes of mucous membranes from chronically infected sinuses, changes which suggest those seen in syphilis. Trotter speaks of the surgical anatomy of the lymphatics in which the sphenoid area drains into the retropharyngeal glands. Fenton discusses noninfectious factors in the etiology of sinus disease with reference to the reticuloendothelial system. De Grosze, Babbitt and Gifford are expressing views in a symposium on diseases of the paranasal sinuses and their relations to disorders of the eye. Novak, Jr., discusses Besredka's theory of immunity. Richards reports that out of 2700 cases treated in the otological department the diagnosis of sinusitis appears only four times in the year 1918, while in 1930, out of 7200 cases it appeared 266 times, a ratio of one to 23. It seemed impossible to believe the ratio had increased 23 times in 12 years, but the reason for this might be greater altertness in diagnosis.

Riggle, speaking of the sphenoid, says it always communicates with the sphenoethmoidal recess and that supernumerary sphenoidal sinuses do not develop because there is only a single potential sphenoidal rudiment. Eagleton regards pain in midline on the top of head as diagnostic of sphenoid suppuration. Fenton and Larsell give a most interesting discourse on experimental and clinical study of histiocytes in acute and chronic inflammation of the accessory sinuses; all experiments being

conducted on cats. Wagner offers valuable information in diagnosis and conservative treatment in sphenoid suppurations, pointing out the danger of injuring adjacent structures; only by intelligent interpretation of subjective symptoms and objective physical findings, can diagnosis be made. He stresses Citelli's syndrome of defective memory, somnolence, insomnia, intellectual deficiency and unwillingness to concentrate. Radiograms of sphenoids seldom show pathology.

Coffin, Harris and DeSanctis express their opinions on diet and vitamins in sinusitis. Hauser discusses the relation between the interior of the sphenoidal sinus and Dorello's canal as he found it in 38 specimens and its clinical significance. Ferris Smith explains his approach to the sphenoid, when intranasal methods fail or are insufficient, by external procedure he removes the sphenoid lining completely.

Butler and Woolley discuss Roentgen therapy in chronic sinusitis, their experiments conducted upon cats, their conclusions to be reported later. Ridpath allures us with his talk on sphenoid sinus, giving a short discussion on early development, size and relation to surrounding structures, discussing symptoms and diagnosis in acute and chronic cases and insisting that time, patience and persistence are necessary for diagnosing this sinus. Latta and Schall speak of the histology of the epithelium of the paranasal sinuses under various conditions. Their study was limited to two specimens received at autopsy. No pathologic disturbance found.

The parting of the ways is come. Let us express appreciation to the men who have so nobly entertained us throughout the journey. There is more to learn and other men to visit, but time does not permit.

The following comments are offered for your consideration. Some years ago I tried to explain the importance of sphenoid sinus disease and the urgency of not neglecting it. I reported the first vacuum sphenoid sinus case; the significance of the pharyngoscope and the success attained in probing every case but one; there is always the necessity for keen and painstaking care in making diagnosis. My work included the first injection of the sphenoid in the living for a radiogram, with the valuable assistance of Dr. Hubeny, who directed the X-ray work. We have given little attention to the X-ray during our journey

since every Roentgenologist has a method of his own. A small hooded light, of my invention, was passed into the sphenoid after dilating its ostea for transillumination; it aided materially in judging the thickness of the partition between the sinuses and the relative size of both cavities if the partition was thin. Irrigation of the sphenoid cavity is dangerous until a free opening is made. The mucous membrane of the sphenoid seems to be especially sensitive to inflammatory changes. When it is necessary to remove the anterior wall, the field must be clearly seen. The middle turbinate or at least the posterior half, should be removed. The sphenoid opening never closes after this operation and can be attributed to but one thing; the removing *in toto* of the anterior wall. To do this the posterior ethmoid cells must be removed and the lower part of the thick anterior wall. The only way I know that this can be successfully done is by the use of the Cavanaugh hooded burr. It is important that the overhanging mucous membrane at the lower part of this wall be removed; if allowed to remain, it will reconstruct itself and close the anterior wall. Where this wall is removed low it is advisable to ligate the sphenopalatine artery. It is necessary to locate absolutely the sphenoid cavity, for I have seen cases where the cavity operated upon was a displaced ethmoid cell, while the sphenoid remained untouched.

In recent conversation Dr. Beck made the pertinent statement that few realized the importance of the sphenoid area.

I would like to draw attention to the position of the basilar process of the sphenoid bone, as to whether it is on a vertical or a horizontal plane. When this process is horizontal there is more liability to Dorello's syndrome.

On a trip through the Orient it was surprising to learn how little was known about the sinuses, especially the sphenoid.

In Calcutta, India, at the Medical College of Bengal, an English doctor, Col. Copinger, head of the eye department, which was well organized and disciplined, showed me an X-ray picture displaying a probe passing through the sphenoid sinus into the cranial cavity with no apparent brain symptoms.

To you, gentlemen, one and all, who have so kindly seen the journey through, my sincere thanks.

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RECORDING OF CLINICAL LABYRINTH TESTS.

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Recording of clinical labyrinth tests is difficult because of the complicated nature of the subject and because of the length of description which the record usually requires. To perform the tests properly and to interpret them correctly is a difficult task even for an advanced student of labyrinth physiology. It requires time, prompt judgment, and constant recording of each phase of the examination. Therefore, testing of the labyrinth cannot very well be entrusted to hospital internes or office assistants unless the procedures are stripped of all their fine details and only the crudest principles are relied upon. Similar difficulties are encountered in consultation practice. Significance of details in a descriptive report will escape practically every physician who is not actively engaged in the labyrinth work. Labyrinth tests are frequently neglected even in the otologists' offices for the same reason: Difficult recording, time required for the tests, complicated nature of the procedure and difficult interpretation unless the specialist is unusually well acquainted with all features of the labyrinth work.

To facilitate labyrinth testing in my office, I have worked out six formulas, which have several advantages: They limit the labyrinth tests to those clinically useful, eliminating duplication; they guide the examiner through the technical details of the tests; they interpret the result either directly or give rules for interpretation; they can be used as consultation reports and are easily understood by a physician unfamiliar with the details of labyrinth physiology; nnally, they are easy to file.

Chart 1—Preliminary Examination (Size 6x4): This chart requires no additional explanation. The adiadochokinesis test and the Wodak-Fischer reflex, which may be less familiar to the average practitioner are explained on the reverse side of the card.

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Chart 2—Spontaneous Nystagmus (Size 6x8): If spontaneous nystagmus is present a great deal of information can be obtained by a close observation and correct interpretation of this phenomenon. The chart is arranged for recording of the nystagmus in different positions of the eyes and in several positions of the head. Use of colors and of symbols simplifies recording.

Ocular nystagmus can be described by a symbol and classified as suggested in the special column. Pendular nystagmus is characterized by equality of both excursions: Disjunctive nystagmus is present, if rhythm of both eyeballs is identical, but the eyeballs move in opposite directions at any given moment. If each eye observes its own rhythm, the nystagmus is dissociated. Latent nystagmus appear only if one eye is under cover.

Chart 3—Static Equilibrium (Size 6x4): This chart is self-explanatory. It is a diagnostic guide as well as a clinical record.

Charts 1, 2 and 3, as well as the first part of Chart 6, (pointing test without stimulation of labyrinth) can be filled out at one visit.

Chart 4—Caloric Test (Size 6x8): Only two positions of the head are selected for clinical caloric test (30° down and 60° backward) and only the horizontal columns Nos. I and II need to be filled out in majority of cases where no active lesions of the labyrinth is suspected. Caloric test is especially valuable if we want to prove or disprove a complete paralysis of one labyrinth. Position of the head 120° down is eliminated from the record and testing in this position is not recommended because its application is cumbersome in clinical and office practice.

Chart 5—Rotation Test (Size 6x8): This test is necessary only for detailed study of special cases. The card is a technical guide giving the position of the head, the direction of rotation, and the position of eyes in which the maximum postrotary nystagmus should be observed. The direction of rotation is described in terms "with the clock" and "against the clock" because the meaning of "rotation to the right" and "rotation to the left" is often perplexing to the beginner. Normal reactions are stated in the respective columns so that any irreg-

ularity in the response to the test is easily noticed. Details concerning the averages of reactions can be found on the reverse of the card. Only two cardinal positions of the head (30° down and 60° backward) are selected for this test because in these positions the nystagmus can be easily observed without changing the position of the head after the rotation—a procedure, which is likely to increase the discomfort of the patient. Tests of the vertical canals with the head 120° down would duplicate the tests already performed with the head 60° backward and are superfluous. If for any special reason it should be desired to test the patient in the 120° down position, a blank space is left at the bottom of the formula for insertion of such a record. Normal postrotary response with head in positions 30° down or 60° backward is presumably a nystagmus occurring in a horizontal plane. But rotary nystagmus is also frequently noticed, since the type of nystagmus is not exclusively determined by the stimulated canal. Head-righting reflexes and lagging of the eyeballs behind the movements and positions of the head also influence the type of ocular muscle reflexes. Types of the nystagmus can be easily recorded by graphic symbols similar to those suggested for recording of the spontaneous nystagmus.

Chart 6—Pointing Test (Size 6x8): The lower part of the record is filled only if detailed study is required. Stimulation of the horizontal canals by rotations and of the vertical canals by hot irrigations is selected for this test because of all possible methods these are best tolerated by the patients. As a rule the test by motion in the shoulder joint only is sufficient for clinical purposes. Should it be desired to test another joint a separate formula has to be used.

Where complete examination of the equilibrium apparatus is required, the caloric test, the rotation test, and the pointing test should be performed on separate days because by prolonged testing the labyrinth reflexes tire.

The set of record cards should be a sufficient technical and diagnostic syllabus even for an inexperienced examiner. Those, who desire to understand the mechanics and the physiology of the tests should study the normal labyrinth reflexes with an aid of a simple labyrinth model represented in Fig. 1. This model is a modification of the visit-card model suggested in Kerrison's text book, "Diseases of the Ear."[1] Both laby-

rinths are mounted on one cardboard plane, which, when held horizontally, represents the position of the head 30° down. The eyeballs and the cochleae are also represented on the plane in their relative positions to the labyrinths. Transferring the cardboard plane from the horizontal into vertical (head 120° down or head 60° backward) or oblique (face 45° right or face 45° left) positions, the relative positions of the canals can easily be noted. The effects of rotation is then understood without much difficulty by anybody who knows the principal laws of the labyrinth reactions: The long component of

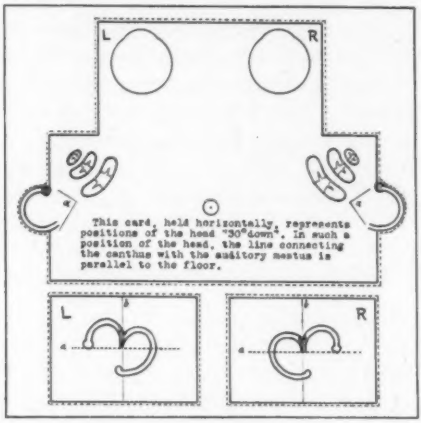
L
R
This card, held horizontally, represents positions of the head "30° down". In such a position of the head, the line connecting the canthus with the auditory meatus is parallel to the floor.
L
R

Figure 1. Cardboard model of the labyrinths. The figures should be cut from a 4x6 filing card along the broken lines. The two smaller squares, representing the vertical canals, should be cut through along the lines a, folded into right angles along the lines b, and mounted over the horizontal canals to fit into the angles.

nystagmus, the direction of the fall and the deviation of extremities all follow the postrotary movement of the endolymph.

For the understanding of caloric tests certain areas are marked red in the canals. Movement of the endolymph toward these areas causes stimulation of the respective canals, while movement of the endolymph from the "red" areas causes depression and preponderance of the contralateral corresponding canals. Remembering that hot water on a bottom of a tube streams upward and cold water on the top of a tube sinks down, the movements of the endolymph in the caloric tests can

be easily figured out on the model. The short component of nystagmus is always directed toward the stimulated or prepondering side.

Labyrinth reactions in cases where only one side is functioning are best understood by the theory, that the degree of reaction is determined to the extent of about +1/3 by the depression, and of about +2/3 by the stimulation or preponderance of the synergistic canals.

The model also very well shows which canals are in identical or in parallel planes and thus act as pairs of synergists for the maintenance of balanced labyrinthine tonus. These pairs are: *1.* Right Horizontal—Left Horizontal. *2.* Right Superior —Left Posterior. *3.* Right Posterior—Left Superior.

SUMMARY.

A system of formulas is suggested for recording of clinical labyrinth tests. The formulas are also technical guides and diagnostic aids for less experienced examiners. A modification of a Kerrison's labyrinth model is presented to help the understanding of the labyrinth reactions.

CHART I.

PRELIMINARY LABYRINTH EXAMINATION.

Name Date
History:

Aural: Discharge
Pain
Deafness
Tinitus

Vertigo
Pallor
Sweat

Nausea
Vomiting
Fainting

Fistula Test:		Deviation of eyes or short comp. of nystag.
Compression of Air in meatus:	R	
	L	
Rarefaction of Air in meatus:	R	
	L	

Wasserman:
Urine:

Spinal Fluid:

EYES

Vision: Pupillary reflex: light accom.
Media: Fundi Muscles

Patellary reflexes:
Adiadocho-kinesis Wodak-Fischer reflex

CHART I (Reversed).

PRELIMINARY LABYRINTH EXAMINATION.

Adiodochokinesis Test: Order the patient to stretch the arm forward and separate the fingers. Let him perform simultaneous rapid motions

with both arms from pronation to supernation. Asymmetry of movements is symptom of cerebellar disturbance or of lesion in the cortical motor area.

Wodak-Fischer Reflex: Patient is standing with eyes closed and arms extended laterally. The arm of the depressed labyrinth side is lower, the arm of the prepondering labyrinth side is higher at the beginning of the test. After a few minutes the arms change their relative positions.

CHART II.

Name Date

SPONTANEOUS NYSTAGMUS.

Nystagmus: (vestibular or cerebellar).	Head: 30 down - 60 back - Face Rt. - Face Left											
	Position of Eyes:											
	Forw.	right 20°	right 45°	left 20°	left 45°	Up	Down	R & Up	R & Dn.	L & Up	L & Dn.	
	Duration and Direction of Short Component:											
→ Horizontal ←												
Rotary												
Diagonal												
Circular												
↑ Vertical ↑												
Ocular Nystag.	Pendular		Disjunctive			Dissociated			Monocul.		Latent	
Weber Test:	128:					512:						

Symbols: ← Short component to the right.
∞ Constant nystagmus.
0 No nystagmus.
? Inconstant nystagmus

Record in colors nystagmi changing with the position of the head. Size of symbol indicates the degree of nystagmus.

Notes:

CHART II (Reversed).

1. Observe small degrees of nystagmus with a binocular loupe.

2. In labyrinth disease the short component of nystagmus is directed either toward the irritated side, or away from the paralyzed side.

3. With a sudden change in the position of the head, the irritative vestibular nystagmus changes its character while the paralytic nystagmus remains unchanged.

4. With the head 30° down preponderance of a horizontal canal usually causes a horizontal nystagmus, while preponderance of vertical canals causes rotary nystagmus.

5. In cerebellar disease maximum spontaneous nystagmus usually occurs when the eyes are directed about 20° toward the contralateral side of the lesion. Its intensity and duration are unequal and inconstant.

6. Weber test is localized in the good ear in paralytic nystagmus and usually in the bad ear in cerebellar disease or in irritative nystagmus.

Differential Diagnosis of:

Physiologic Nystagmus.	Pathologic Vestibular Nyst.
a. Lasts only a few seconds.	Constant, (in active stage.)
b. Only in lateral positions.	In all positions.
c. Equal in all positions of eyes.	Accentuated, if eyes are turned in the direction of short component.
d. Direction of the short component changes with the side to which the eyes are turned.	Direction of short component does not change with the position of eyes.
e. Not influenced by movements of the head.	Irritative nystagmus stronger after movement of head.
f. No vertigo and ataxia.	Vertigo and ataxia present.
g. No tendency to fall.	Tendency to fall in the direction opposite to the short comp. of nystagmus.

CHART III.

Name Date

STATIC EQUILIBRIUM

Position of Head:	30° Down	60° Back	120° Down	Face Rt.	Face L.
Direction of Fall:	R	R	R	R	R
Lesion:	Prepond. of L lab.	Prepond. of L. lab.	Prepond. of R. lab.	Cerebellum.	Cerebellum.
Direction of Fall:	L	L	L	L	L
Lesion:	Prepond. of R lab.	Prepond. of R. lab.	Prepond. of L. lab.	Cerebellum.	Cerebellum.
Direction of Fall:	Forward	Forward	Forward	Forward	Forward
Lesion:	Cortical or Funct.	Cortical or Funct.	Cortical or Funct.	Prepond. of R. lab.	Prepond. of L. lab.
Direction of Fall:	Backward	Backward	Backward	Backward	Backward
Lesion:	Cortical or Funct.	Cortical or Funct.	Cortical or Funct.	Prepond. of L. lab.	Prepond. of R. lab.

CHART III (Reversed).

STATIC EQUILIBRIUM.

1. Direct the patient to stand with heels and toes close together and close his eyes. The head should be turned sharply into the different positions.

2. In cerebellar lesions the direction of fall is usually constant and does not change with the position of the head. Constant fall backward may mean cerebellar lesion (vermis). Constant fall forward is usually functional.

3. The differential diagnostic value of equilibrium test is limited, because the direction of fall is influenced by many complicated body-righting reflexes.

CHART IV.

Name Date

CALORIC TEST

Position of the Head	Canal Stimul. or Inhib.	Ear Irrigated	Temp. of Water	Eyes to	Short Component After 100 cc. of Water: Direction	Short Component After 100 cc. of Water: Duration	Quantity of Water Necessary for Nystagmus to Be	Conjugate Deviation
STIMULATION								
I 30° Down	R. super.	R.	Hot	R.	R.		p	
	L. super.	L.	Hot	L.	L.		p	
II 60° Backw.	R. horiz.	R.	Hot	R.	R.		p	
	L. horiz.	L.	Hot	L.	L.		p	
INHIBITION								
III 60° Backw.	R. horiz.	R.	Cold	L.	L.		p	
	L. horiz.	L.	Cold	R.	R.		p	
IV 30° Backw.	R. super.	R.	Cold	L.	L.		p	
	L. super.	L.	Cold	R.	R.		p	
	1	2	3	4	5	6 7	8	9 10

p = produced; s = stopped; d = diminished; r = reversed.

Notes:-

†Normal: Nystagmus appears after about 70 cc. of water has flowed through the meatus within about 16 seconds.

CHART IV (Reversed).

CALORIC TEST.

1. R. and L. always refer to the patient's right and left side.

2. Hot water should have a temperature of 42°-47° C. (107-118 F.).

Cold water should have a temperature of 20°-30° C. (68-86 F.).

3. The water should run from a vessel elevated about 50 cm. above the meatus. If the reaction appears after the first 100 cc. of water, note down the time of nystagmus in column 8. If more than 100 cc. of water is necessary to produce nystagmus, note down the quantity of water in column 9, p. Lowered caloric reaction may be physiological.

4. The arrangement of the test should follow numbers I, II, III, IV in column 1. If there is a spontaneous vestibular nystagmus, use only inhibition reactions on the side toward which the short component is directed, and only stimulation reactions on the opposite side. Note down the quantity of water necessary to produce change in column 9, (d—diminished, s—stopped, r—reversed.)

5. If one labyrinth is destroyed, there will be no reaction from the stimulated or inhibited canals of one ear.

6. In cerebellopontine angle lesions there are no reactions from the homolateral canals. The only reaction present is that from the horizontal canal of the contralateral side.

7. In cerebellar lesions the labyrinth reactions are normal.

8. In cerebral lesions stimulation of homolateral labyrinth may produce conjugate deviation of eyes to the stimulated side. Stimulation of the opposite labyrinth produces normal nystagmic reactions.

CHART V.

Name Date

ROTATION TEST

Position of the		Canal	Rotation:	Eyes	Short Component	
Head	Face	Stimulated		to	Direction	Duration
30° Down	Forward	R Horiz	Ag. clock (L)	R	R	Normal 15-30 sec.
	Forward	L Horiz	W. clock (R)	L	L	
60° Backw.	45°L	L Super	Ag. clock (L)	L	L	
	45°R	R Super	W. clock (R)	R	R	
60° Backw.	45°R	L Poster	Ag. clock (L)	L	L	
	45°L	R Poster	W. clock (R)	R	R	

Notes:-

CHART V (Reversed).

ROTATION TEST.

1. R. and L. always refer to the patient's right and left side.

2. Each canal is tested by 10 revolutions in 20 seconds.

3. Do not change the position of patient's head after the cessation of rotation. Observe the nystagmus in the original position.

4. If there is spontaneous vestibular nystagmus and vertigo, test only the posterior canal of the side towards which the slow component of nystagmus is directed. Information about the other canals can be obtained by caloric tests.

5. Normal duration of after-nystagmus according to Barany:
Horiz. nystagmus to right 20-25 sec.
Horiz. nystagmus to left 25-38 sec.
Rotary nystagmus 15-18 sec.
Normal duration of after-nystagmus according to Malan:
Less than 15 sec. 9.61% of people.
15-30 sec. 83.27% of people.
More than 30 sec. 7.12% of people.

6. Reaction from stimulation of corresponding canals of either side should be of approximately equal durations in normal labyrinths. If there is a disproportion of 1:3, the side showing shorter reaction is destroyed.

7. American standards for postrotary nystagmus, in aviation tests: Not more than 36 sec., not less than 16 sec.

CHART VI.

Name Date

POINTING TEST. JOINT:

Position of the Head	Canal Stimulated	Kind of Stimulation	Direction of Motion	Deviation of the Right Extremity	Deviation of the Left Extremity
30° Down	None	None	From above		
			From below		
	None	None	From the R		
			From the L		
	R Horiz	Rotation L (Ag. the cl.	From above	L	L
			From below	L	L
	L Horiz	Rotation R (W. the cl.)	From above	R	R
			From below	R	R
	R Superior	Hot irrigation R.	From the R	U	U
			From the L	U	U
	L Superior	Hot irrigation L.	From the R	U	U
			From the L	U	U

Notes:—

CHART VI (Reversed).

POINTING TEST.

1. R. and L. always refer to the patient's right and left side or extremity.

2. Routine test is performed with an arm stretched forward or laterally and by motion in the shoulder joint. The point in space (the examiner's finger) is to be met by the tip of the patient's index finger. Tests by motions in the other joints (wrist, elbow, hip) should be recorded on separate formulars. The patient's eyes are closed during the test.

3. Testing without stimulation: In labyrinth disease both extremities deviate either from the irritated side or toward the paralyzed side. In cerebellar disease there are transitory inconstant disturbances on the diseased side. The homolateral extremity usually deviates laterally.

4. Turn the patient 10 times in 10 seconds for each horizontal canal test. Use 100 cc. of warm water (42-47 C.; 68-86 F.) for each superior canal test.

5. Normal deviation of 8″-12″ given in the fifth vertical column refers to the shoulder joint test and diminishes about one-half before the test

of each canal is finished. (I.e., if immediately after the stimulation of the canal the patient has tried to meet the point in space once with his right hand and once with his left hand, the second trial with his right hand will show only about one-half of the deviation found at the first trial.)

6. In cerebellar disease there may be normal reactions after stimulation of the labyrinth.

7. Change of position of the head after stimulation does not influence the deviation of the extremity.

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30-28 Thirty-sixth Street.

AN ANALYSIS AND REPORT OF 10 CONSECUTIVE CASES OF SINUS THROMBOSIS WITH RECOVERY.*

DR. GEORGE D. WOLF, New York.

The deaths resulting from sinus thrombosis, as recently reported from several European and American clinics, vary from 13 to 57 per cent. Lillie[1] reports a mortality of 13.4 per cent in 52 cases studied at the Mayo Clinic. Brunner,[2] of Vienna, in 154 cases had a death rate of 22 per cent. At the Massachusetts Eye and Ear Infirmary, Boies[3] reviews 184 cases with a mortality of 25 per cent. Fröding,[4] of Sweden, reports 27.9 per cent mortality in 61 cases. Eliasson,[5] of Leningrad, and Mygind,[6] of Copenhagen, both report a rate of 36 per cent in 121 and 199 cases respectively. Glass,[7] in England, had 57 per cent of deaths in a series of 63 cases. A compilation of 1045 cases, reported by 17 different authors, was prepared by Haymann,[8] of Munich; the combined mortality rate was found to be 34 per cent.

This report concerns 10 consecutive cases of sinus thrombosis with no mortality. Of course, it is not my purpose to intimate even remotely that this happy outcome could be sustained in a larger series of cases. On the other hand, the results are not entirely accidental and can be accounted for in part by the following considerations:

1. All the 10 patients were in good general condition, and were seen early in the course of the disease.

2. In all instances the involvement was unilateral, thus pointing definitely to the side affected.

3. The splendid co-operation on the part of the laboratory, the house staff and the nursing staff was a factor of no mean importance in securing the favorable results.

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*Presented before the Sydenham Hospital Clinical Society, March 4, 1935. From the Otolaryngological Department of Sydenham Hospital.

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4. In none of these cases was a mastoidectomy performed simultaneously with the obliteration of the lateral sinus and the ligation of the jugular vein. Thus prolonged operation with resultant shock to the patient and excessive loss of blood was avoided.

This small group of cases cannot serve as a basis for either a statistical study or major conclusions on the subject of sinus thrombosis. However, the cases were sufficiently dissimilar in their clinical manifestations and in the surgical problems they presented to make their study justifiable.

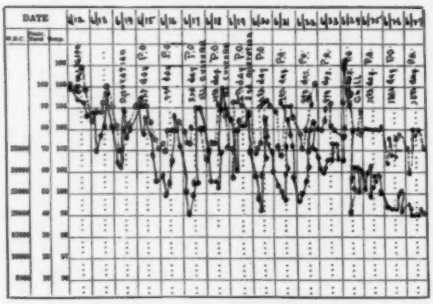

Fig. 1. Case 1.

COMMENTS.

The salient features of these 10 cases are tabulated in Chart I, and a detailed history of each case would therefore be superfluous.

Cases 1, 2, and 3 are examples of so-called primary jugular bulb thrombosis. Case 1 (see Fig. 1) and Case 2 presented no particularly difficult problem, either in diagnosis or as regards indication for surgical treatment. In Case 3 (see Fig. 2) there was a negative blood culture at first, but when the temperature rose to 107° F., ablation of the lateral sinus was decided upon. Culture from the sinus was subsequently reported positive.

The typical postoperative course of sinus thrombosis is illustrated in Cases 4 and 5. In Case 4[9] symptoms did not appear until the seventh day after mastoidectomy, while in Case 5 severe chills and high temperature were evident 24

hours after operation (see Fig. 3). The latter was an instance of chronic mastoiditis in which a radical operation had been contemplated, although only a simple one was finally performed.

Cases 6 and 7, the latent or silent type of sinus thrombosis, were the most interesting in the series, because the diagnosis remained obscure for a long time. The symptoms markedly simulated other intracranial complications, particularly petrositis. Both were cases of recurrent mastoiditis. In Case 6 the ear symptoms recurred five years after the first mastoidectomy. The second operation was uneventful and the patient left the hospital on the seventh postoperative day. She returned to my

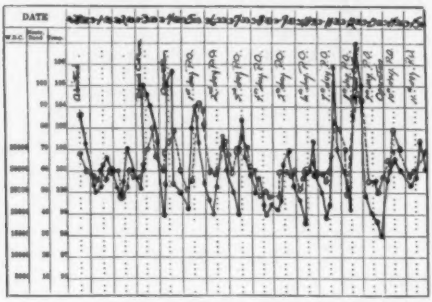

Fig. 2. Case 3.

office for treatment. On the nineteenth postoperative day, when the mastoid wound was almost closed, her temperature suddenly rose to 105° and she complained of excruciating headaches with pain over the right eye. She was readmitted to the hospital for observation. A blood culture taken on admission proved negative. At the same time, the temperature dropped to normal, and after four days at the hospital, the patient returned home. Three days later her temperature again rose to 105° and she was admitted to Mt. Sinai Hospital. (From this point the case is reported through the courtesy of Dr. I. Friesner on whose service at Mt. Sinai Hospital the patient was operated upon by Dr. W. Horn.) For three weeks she was kept under observation on the pediatrics service, during which period the temperature rose sharply three times at intervals of approximately one week. During the intervening

CHART I. AN ANALYSIS AND

Case	Sex	Age	Duration of Ear Symptoms	Ear Drum	Blood Culture	Mastoiditis Type
1. L. B.	F.	9½	10 days	Ruptured spontaneously after 48 hours.	Strep. viridans.	Hemorrhagic
2. E. T.	F.	6½	8 days	Incised after 2 days.	Strep. (type not stated).	Hemorrhagic
3. R. N.	M.	6	9 days	Ruptured spontaneously after 2 days.	Strep. nonhemolyticus.	Coalescent.
4. J. M.	F.	40	15 days	Incised after 1 week.	Staph. albus.	Coalescent.
5. P. R.	F.	18	7 years	Ruptured spontaneously 7 years before. before.	Strep. nonhemolyticus.	Coalescent.
6. I. M.	F.	6	5 days	Incised after 24 hours.	Strep. hemolyticus.	Recurrent.
7. R. P.	F.	4	3 months	Incised after 2 days.	Strep. nonhemolyticus.	Recurrent.
8. C. K.	F.	22	14 days	Incised after 1 week.	Negative.	Coalescent.
9. W. R.	F.	2½	5 days	Incised after 5 days.	Strep. nonhemolyticus.	Coalescent.
10. G. A.	F.	4	2 days	Incised after 2 days.	Strep. hemolyticur.	Coalescent.

T I. AN ANALYSIS AND REPORT OF 10 CONSECUTIVE CASES OF SINUS THROM

Culture	Mastoiditis Type	Culture from Mastoid	Bony Covering of Sinuses	Lapse of Time between Mastoid and Sinus Operation	
viridans.	Hemorrhagic.	Strep. (type not stated).	Normal-intact.	3 days	Jugu
(type not).	Hemorrhagic.	Bacillus pyocyaneus.	Normal-intact.	3 days	Jugu
nonhemo- s.	Coalescent.	Strep. brevis.	Normal-intact.	7 days	Free an
albus.	Coalescent.	Staph. albus.	Normal-intact.	7 days	Obl lat
nonhemo- s.	Coalescent.	Strep. (type not stated.	Eroded in center; much pus under pressure.	2 days	Mur
hemolyti-	Recurrent.	Strep. nonhemolyticus.	Small central perforation. Pus under pressure.	45 days	No
nonhemo- s.	Recurrent.	Strep. nonhemolyticus.	Normal-intact.	29 days	Thr Co ju
e.	Coalescent.	Strep. (type not stated).	Accidentally injured during operation (?).	21 days	Col ju
nonhemo- s.	Coalescent.	Strep. nonhemolyticus.	Lower half of bony covering eroded, sinus wall healthy.	.....	No la
hemolyti-	Coalescent.	Strep. hemolyticus.	Central erosion; pus under pressure.	5 days	Thr fo

ROMBOSIS WITH RECOVERY.

Operative Findings	Postoperative Course	Time in Hospital	Comment
Jugular bulb involvement.	Uneventful.	22 days	So-called primary jugular bulb involvement.
Jugular bulb involvement.	Uneventful. Sessile growth 1½ years later in scar.	21 days	So-called primary jugular bulb involvement.
Free bleeding from torcular and jugular end.	Uneventful. Erysipelas of face before sinus operation.	28 days	Erysipelas of face following mastoidectomy obscured the picture.
Obliterating thrombus in lateral sinus.	Erysipelas 35 days after operation.	33 days	Staphylococcemia.
Mural thrombus.	Uneventful. Transfusion.	14 days	50 colonies per cc. of blood on agar plate.
No thrombus.	Uneventful. Transfusions.	.....	Diagnosis obscure. Latent type.
Thrombus in lateral sinus. Collapsed lateral sinus and jugular vein.	Pyelitis. Transfusions.	20 days	Symptoms pointed to brain abscess or petrositis.
Collapsed lateral sinus and jugular vein.	Cerebellar abscess, pulmonary abscess septic arthritis. Transfusion.	55 days	Pyemic infarcts justified the diagnosis in spite of negative blood cultures.
....No operation performed on lateral sinus.	Uneventful. Transfusion.	14 days	Positive blood culture. Recovery without operation.
Thrombus from jugular bulb, followed by free bleeding.	Metastatic abscess of left hip. Transfusion.	21 days	Fulminating type following measles.

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period, the patient seemed perfectly comfortable. The third blood culture taken at Mt. Sinai Hospital proved positive, and she was operated upon. Recovery was uneventful. This case is included in the present series because of its unusual clinical features.

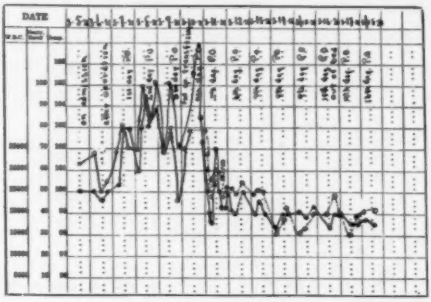

Fig. 3. Case 5.

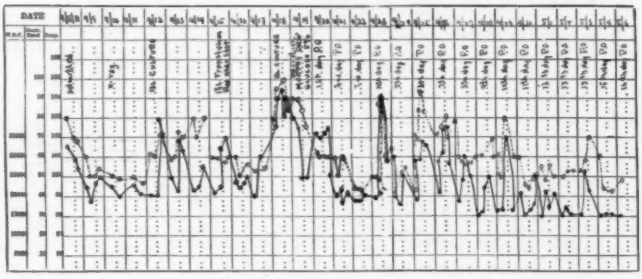

Fig. 4. Case 7.

Case 7 was operated upon by me for a double mastoiditis two years previously. She then returned with a left recurrent mastoiditis, complaining chiefly of left hemicrania and deep pain at the left side of the neck. Revision of the mastoid was performed, and was followed by an uneventful postoperative course. Soon after the patient's discharge from the hospital, her temperature began to fluctuate between 99° and 101°, and her general condition appeared unsatisfactory. Headaches and pain in the neck recurred; she grew pale and lost weight. Three weeks after the second mastoidectomy, her temperature rose to 103° (see Fig. 4). The patient became

apathetic and irritable, and her headaches increased in severity. Some intracranial complication was suspected, but a definite diagnosis could not be made. The patient was readmitted to the hospital; the blood culture proved positive, and operation was performed. Both the sinus and the jugular vein were found to be collapsed; the jugular vein had the appearance of a fine thread.

In spite of the delay in operation, which in Case 6 took place 45 days after the second mastoidectomy, and in Case 7, 29 days after, both patients made an uneventful recovery.

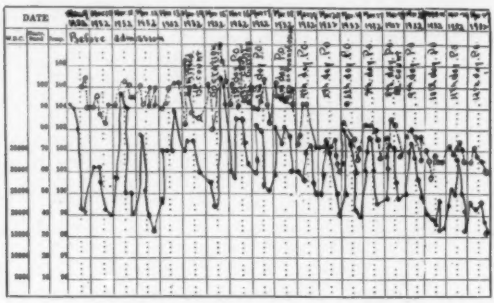

Fig. 5. Case 9.

Case 8 ran a very stormy course with many complications; however, the patient recovered and is well at the present time.

Case 9 (see Fig. 5), in which there was a positive blood culture and a typical clinical course, illustrates the possibility of recovery from sinus thrombosis without operation on the lateral sinus. On the day the positive blood culture was obtained, operation was contemplated, but simultaneously the patient's temperature dropped and thereafter remained normal.

Case 10 (see Fig. 6) represents the fulminating type in which a coalescent mastoiditis followed measles. Two days after paracentesis a subperiosteal abscess appeared. At operation a thrombus was found in the jugular bulb and free pus in the sinus. A week later a pyemic focus in the left hip joint was discovered.

To the best of my knowledge, all these patients are alive and well at the time of this report.

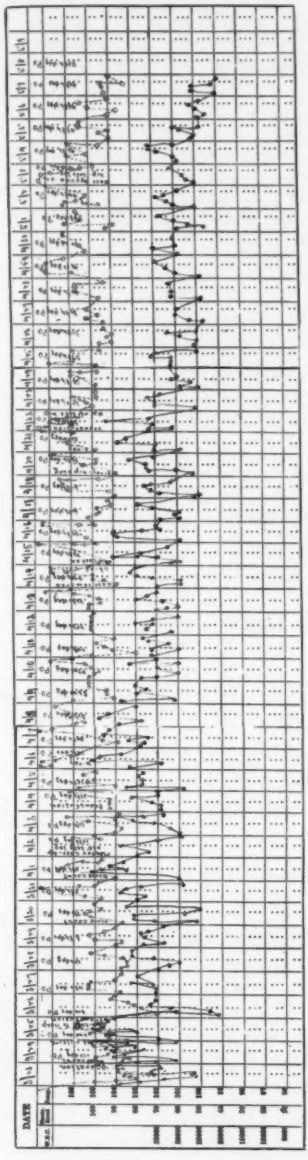

Fig. 6. Case 10.

SUMMARY.

No. of cases	10	Recovery	10	100%	
Sex: Female	9	Male	1	90%	10%
Age: Children	7	Adults	3	70%	30%
Age range from 2½ to 40 years. Average age 11.8 years.					
Side involved:					
Right	5	Left	5	50%	50%
Site involved:					
Lateral sinus	7	Jugular bulb	3	70%	30%
Tympanic membrane:					
Incised	7	Ruptured spont.	3	70%	30%
Types of mastoiditis:					
Hemorrhagic	2			20%	
Coalescent	6			60%	
Recurrent	2			20%	
Systemic symptoms (sinus thrombosis):					
Preceding mastoidectomy	5			50%	
Following mastoidectomy	5			50%	
Sytemic symptoms associated with					
Acute mastoiditis	7			70%	
Chronic mastoiditis	1			10%	
Recurrent mastoiditis	2			20%	
Operative procedures:					
Obliteration of lateral sinus and ligation of jugular vein	8			80%	
Resection of jugular vein	1			10%	
Recovery with only mastoidectomy and transfusion	1			10%	
Bony covering of lateral sinus:					
Normal-intact	5			50%	
Diseased	5			50%	
Transfusion (cases)	6			60%	
Length of hospitalization — 14 to 55 days; average, 23 days.					

Blood Count: Hemoglobin: highest, 75 per cent; lowest, 50 per cent; red corpuscles between 3,000,000 and 4,000,000; white corpuscles from 9,000 to 29,000 (majority ran about 17,000).

Blood Culture: Positive, 9; 90 per cent. Negative, 1; 10 per cent.

TYPE OF ORGANISM.

From Blood		From Mastoid		Organism from Mastoid and Blood Culture		
Strep. viridans	1		0			
Strep. hem	2		1	Same	4	40%
Strep. nonhem	3		3	Diff.	6	60%
Strep. (type not defined)	1		2			
Strep. brevis	0		1			
Staph. albus	1		1			
B. pyocyaneus	0		1			
Negative	1		0			

Complications: **Six cases, 60 per cent.**

Number of Complications—8: **Erysipelas, 2; fibromyoma, 1; pyelitis, 1; abscess, 3 (hip, cerebellum, lung); septic arthritis, 1.**

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1075 Park Avenue.

CLINICAL BIOCHEMISTRY IN THE TREATMENT OF EAR, NOSE AND THROAT DISEASES.*

DR. F. B. BLACKMAR, Columbus, Ga.

Nutritional chemistry, in relation to cattle and fertilizers, has made great advances. No one thinks it remarkable for a planter to supply extra calcium when he limes his soil for alfalfa, nor when he supplies potash, phosphorus or nitrogen. Contrast the above factors; calcium, phosphorus, nitrogen and potash, which are studied and considered all important by the planter, with our old idea of carbohydrate, fat and protein, giving no consideration to those elements which are also prime factors. Individual tissue changes suggest a need for some elements and an over-supply of others. Many diseases and many ordinary symptoms are really cries for something to relieve a deficiency or to balance an excess. The newer attitude is to consider a person's intake of calcium, phosphorus, iron, iodine, sulphur, nitrogen, sodium and potassium; and where a deficiency is suspected to attempt to supply the need by changes in diet or by the administration of medicines. This is not so difficult as it might seem. It is not necessary to memorize long tables of chemical analyses of foods. One's general knowledge with a little help will often be found quite sufficient. Foods may be grouped into a few classes and the outstanding chemical characteristics of each are not difficult to keep in mind. In selecting drugs this is a new point of view and often formerly seldom used drugs seem to gain in importance. In some instances manufacturing houses have co-operated by evolving entirely new agents and in one instance (the use of suprarenal cortex extract) it was found best for several members of the group to manufacture their own glandular extracts in order to use a fresh preparation.

In a former article the author[1] used the term "autonomic level" to indicate the resultant of the antagonism between the two parts of the autonomic nervous system. As there was no

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term to express the resultant of all equilibria this term was used to stand for the resultant of all equilibria. This use requires constant explaining and confusion. As a substitute the nervous, chemical and glandular level, abbreviated to "N.C.G. level," seems the least confusing expression.

Of the three major groups of factors: *1.* Autonomic; *2.* glandular; and *3.* chemical, it is impossible to say which is most important. The autonomic system is intimately associated with the activities of the glands of internal secretion. It is not unreasonable from many findings to believe that the chemical equilibria also produce part of their effects through stimulation or inhibition of the anabolic or catabolic glands of internal secretion and so each of the three groups of factors are interlocked with the others to form a chain.

Some diseases and their etiological factors, according to present conceptions of some observers, can be placed in two antagonistic groups.

Certain of the factors belonging to opposite main groups seem to pair off as special antagonists. There are acids combating alkalies, sodium combating potassium, calcium versus phosphorus, sulphur and light metals versus the heavy metals, and the catabolic glands of internal secretion versus the anabolic glands.

Changes in the color of the nasal septum give those who have trained themselves to judge these colors the most easily obtained preliminary idea of conditions present, subject to the following limitations:

The author personally feels that the color of the nasal septum indicates the local resultant of the antagonistic factors of the autonomic nervous system; the resultant of the antagonistic secretions of the glands of internal secretion; and the resultant of chemical antagonisms in the intercellular fluid as present in the nasal mucosa, in particular and generally, but not always, this parallels the resultant of these factors in the body as a whole. Occasionally patients are seen whose history, basal metabolism, urinary acidity, blood pressure and therapeutic results do not confirm the indications of the color of the septum. This can only be explained as a local divergence in the septal color not in accord with the resultant in the body as a whole and in most instances the local factor responsible can

be found. If the sinus infection, dental abscess, or whatever it is, is corrected then frequently the septal color will truly indicate the resultant of the body as a whole.

A factor in the septal color change can be the actual color of the blood itself. In anemia there is a tendency toward paleness of the septum. However, even with anemia there may be capillary dilatation from changes in nerve stimulation and the septum may present various shades of redness despite the anemia.

THE AUTONOMIC NERVOUS SYSTEM.

The autonomic nervous system is composed of two antagonistic parts: the sympathetic and the parasympathetic system. The latter is the cranial and sacral part of the system. There is a constant attempt between these two parts to maintain a balance. This balance is normally frequently upset for short periods of time but it should soon return to a condition of equilibrium. Following exercise fatigue, fear, anger and under the influence of certain drugs the sympathetic system dominates the control of the body. During such periods the reserves of the body are mobilized and depleted. Animal starch, called glycogen, changes to blood sugar during the period of sympathetic dominance. A stored substance in the cortex of the suprarenal gland is also mobilized, resulting in a loss in weight in these glands. At other times, such as during rest, the parasympathetic system dominates the body. Reserves are again built up. Blood sugar is removed from the blood and stored as glycogen during this period.

The sympathetic system is composed of a network of connected nerves. An impulse at one point, if strong enough, can travel throughout the entire system. The effect of these impulses varies according to the part affected. Thus, the abdominal vessels contract, forcing more blood away from the organs of storage (the liver and spleen) to the skeletal muscles, heart, lungs, brain and the nasal septum if the septum is free from local antagonistic influences.

Such facts as the following lead to the belief that sympathetic activity besides resulting in the well-known vascular dilatation of the brain, heart and lungs, also is regularly associated with vascular dilatation in the nose and a red nasal septum. In a number of patients with pathology near the

thoracic or cervical sympathetic chain, on one side only, it has been seen that the septum on this side was more red than on the other side. When a red septum is seen on one side only, the author considers the possibility of a local staphylococcus or streptococcus infection in the sinuses, then looks for abscessed teeth, especially an upper tooth on the red side, then the tonsils and cervical lymph nodes on the red side, then chest pathology on the red side, then an appendix or even a tube on this side. This idea of sympathetic irritation is not new, for years ago a series of papers suggested a search down the side of a slightly enlarged pupil and a single drop of homatropine had been instilled into each eye, noting the effect on the two pupils. Sympathetic irritation was suspected on the side upon which the pupil dilated most rapidly. That this unilateral character does not necessarily always occur is suggested by cases of a quiescent subacute appendicitis, which have been seen by the author, with a bilateral red septum which could not be explained until the appendix became more active. Following the appendectomy the septum returned to its normal color, neither red nor pale.

The word edema as used in connection with cardiorenal disease and edema as used in relation to the nasal mucosa in allergy are not only different, but clinically it appears that the factors which benefit one are harmful to the other.

Changes take place in the kidney similar to those in the nasal secretory cells. With the administration of potassium, diuresis corresponds to nasal rhinorrhea. With an increase in the intake of sodium a decrease in urinary secretion occurs which corresponds to the improvement in allergic serous discharge. The analogy between the nose and kidney is strengthened by the observation that a common prodromal symptom of an allergic attack is polyurea.[2]

Nasal edema occurs in association with those factors on the side of parasympathetic dominance and is the opposite condition to the vascular congestion which occurs with those factors on the side of sympathetic dominance.

Sodium chloride and a meat diet are ill advised in cardiorenal edema but are often helpful in nasal allergic edema. Acid is used as a diuretic in some cases of nephritis, which would seem quite contrary to the above ideas. It may be that

these are allergic kidneys in which cellular enlargement is relieved as a result of acid administration and circulation is improved, resulting in diuresis. If this is true, such patients in whom diuresis is produced by the use of dilute hydrochloric acid might be expected to show pale septa rather than the red septa usually seen in nephritis.

In reference to the patient's psychology the color of the septum indicates two different psychological types. A red septum patient often awakes in the morning unrefreshed and still fatigued. He is conscious of muscular strength and may be best described as a fatigued strong person. Cannon[3] has shown that fatiguing emotions produce bodily changes which fit in with this conception. The pale septum patient, always granting that the color of the septum reflects the general bodily condition and is not a purely local alteration, is usually more phlegmatic and feels weak. Red septum patients need all the rest they can get, while pale septum patients should be encouraged to attempt exercise, stopping upon the first signs of fatigue but trying again after short rests.

The difficulty is that red septum patients who need rest are apt to be restless, intensive workers, while the pale septum people who need progressive exercise usually feel so weak they are hard to stir into activity. There are many exceptions to this conception as, for instance, several doctors among the author's friends who are noted for their untiring ability have pale septa, low blood pressures and are mildly allergic. Pale septum patients frequently state that they have difficulty in keeping warm and their fingers and toes, "go to sleep," and feel numb when they lie down at night or sit still for a while.

High altitudes seem to hold less horror for red septum people than those with pale septa. An interesting observation in this line was noted by the author among student pilots. Although the overwhelming majority of the author's patients present pale septa, it is uncommon to find anything other than various degrees of redness in the septa of airplane pilots.

The blood pressure is of great help in understanding patients' psychology from the point of view of the resultant of the various equilibria, or, let us say, the septal color. A young adult with a red septum will probably have a normal blood pressure, unless there is advanced nephritis or diabetes with vascular sclerosis, when it would be elevated. A red septum

and low blood pressure are contrary indications which call for additional study of the case. Often a local cause for the red septum will be found and, if corrected, the septum will correctly indicate the patient's autonomic, chemical and glandular resultant as being displaced toward the side of parasympathetic dominance. Low systolic blood pressure would be expected with a shift of the body resultant toward the pale side. With the administration of suprarenal extract prepared for oral administration this low blood pressure frequently rises to normal and often remains there long after its administration has been discontinued. Usually it does not rise above 120 even if the extract is continued. In working with this extract it commonly happened that pale septum patients were seen with high blood pressure often as high as 240. Wishing to use the oral suprarenal extract for relief of nasal complaints it was given with fear and trembling in tiny doses, for in many cases proof that it elevated low blood pressure was at hand. In place of rising, such high pressures gradually fell, often as low as 120. In old people the finding of pale septa and high blood pressure is a most common occurrence. The improvement in these patients' general feeling is indeed gratifying.

THE EFFECT OF MENSTRUATION ON THE COLOR OF THE NASAL SEPTUM.

In several instances an error in estimating the N.C.G. level had been made due to impending menstruation. For a day or two before the commencement of menstruation there is often a temporary shift toward redness of the nasal septum color. This will partially balance an N.C.G. shift toward the allergic side if already in evidence; a neutral septum may become red or a slight tendency to septal redness may become temporarily exaggerated. With the commencement of menstruation the color of the septum returns to its usual color plus a slight shift to the pale side. The natural inference would be that this paleness is due to loss of blood but from an autonomic and a glandular point of view it may be evidence of an N.C.G. shift. Although it has not so far been the author's good fortune, since being interested in this matter, to examine the color of the nasal septum in a patient with menstrual epistaxis (vicarious menstruation), it seems reasonable to associate it with this shift toward active congestion in the nose.

CHEMICAL EQUILIBRIA.

Disturbances of the acid base ingestion ratio probably assumes first place among the chemical equilibria. An excessive intake of nonoxidizable acids or acid ash foods on one hand or alkaline foods on the other often seems to be alone responsible for many patients' symptoms, for disappearance of symptoms often follows the indicated acid alkali corrections. According to the doctor's inclination he can rest with asking how much meat, starches and sweets, fruits and vegetables are eaten or he can ask the patient to keep a diet history until the next visit. The latter method must be used at once if the patient is recognized as one of the many who anticipate criticism and deny excesses. They must receive no suggestion of criticism until a record of a few days is at hand which can not be denied. In general meats, fats, fish and carbohydrates can be considered foods tending to produce an N.C.G. shift to the red septum side. Almost all fruits and vegetables are foods tending to relieve symptoms associated with an N.C.G. shift toward the red septum side.

Hydrochloric and nitrohydrochloric acid or sodium acid phosphate are the principal inorganic agents in this group. It is probable that these agents should not be continued after the urine acidity is elevated moderately or the reaction of the saliva becomes acid. Should this occur other agents can be used in attempting to produce a resultant N.C.G. shift toward sympathetic dominance. As the absorption of both sodium and phosphorus aids in shifting toward septal redness it would seem that the use of sodium acid phosphate might have a triple indication in pale septum patients.

Besides the allergic complaints which bring them to the rhinologist, pale septum patients will often give a history of digestive disorders of various types. It is believed by some internists that gastric ulcers in these patients are of an allergic nature. At any rate, low or absent hydrochloric acid in the gastric secretion would furnish a double indication for the administration of dilute hydrochloric acid or nitrohydrochloric acid. Many of these pale septum patients complain of a choking fullness in their throats. Many have learned to relieve this by taking soda which quickly empties the gastric content; but it is well to remember that free hydrochloric acid in excess of that which can be absorbed by the food in the stomach is

one of the natural means of relaxing the pyloric sphincter and so a sufficient dose of hydrochloric acid may produce the same results eventually as is so rapidly accomplished by the use of soda.

Acids of fruits, such as citric acid, form salts which are absorbed and with the elimination of carbon dioxide the alkaline ions remain. Such foods are acids in effect only until absorbed. After absorption citrus fruit juices, berries and fruits which contain citric acid really tend to increase the alkaline reserve of the body.

With red septa potassium bicarbonate and citrate have each a double indication since potassium tends to produce a shift away from a red septum and the bicarbonate and citrate ions are efficient alkaline agents.

The clinical application of knowledge in reference to the sodium potassium equilibrium is that salty foods should be withheld from red septum patients and they should be encouraged to eat more leafy vegetables as these are especially rich in potassium. There is on the market a pysiologically balanced salt which closely resembles the composition of human plasma. It is claimed that since its sodium is balanced with calcium and potassium it does not increase any sodium excess already present and that patients do just as well with food flavored with it as on a salt free diet. The author has found it quite impossible to tell this salt from sodium chloride by looks or taste. Where active medication is needed, besides reducing the salt intake, to balance an excess already present, the same firm offers tablets with the same formula as the table salt except that all sodium is eliminated. These tablets practically serve the same purpose as alkaline medication.

An excessive intake of salt is interesting in view of the stimulating effect of salt upon the suprarenal glands. Dogs deprived of their suprarenal glands live longer if quantities of sodium chloride are given. On the other hand patients with deficient suprarenals are made worse by a salt poor diet and this salt poor diet has been used as a provocative test for Addison's disease.[4]

In selecting an alkaline agent it would seem that the old A.B.C. mixture would be hard to improve upon as it consists of the acetate, bicarbonate and citrate salts of potassium, thus

tending to produce a shift toward the pale side with both ions of each ingredient. Sodium bicarbonate would seem less efficient due to sodium being a factor exerting a force toward sympathetic dominance. If this A.B.C. mixture is given after meals a slow absorption is provided. When given on an empty stomach even red septum patients often notice a tingling of the extremities such as pale septum people often experience constantly.

Sodium chloride would seem to be an ideal agent for attempting a shift toward the red side, as both the sodium and chloride ions are thought to exert force toward sympathetic dominance.

Intravenous hydrochloric acid has received much notice recently and the author prefers not to praise or condemn its use but only to state that patients with pale septa have been seen to rapidly shift in color toward redness following each of a series of such injections. Many of these patients exhibited improvement in their allergic symptoms accompanying the shift in the color of the nasal septum.

The fluid tolerance of an individual probably depends largely upon the sodium potassium equilibrium, and patients with red septa seem to improve with the use of fluids in large quantities. On the other side the author has seen allergic symptoms entirely relieved after the deliberate excessive use of water by patients had been discovered and stopped.

Calcium and phosphorus may constitute an important equilibrium in the body. Phosphates exert force upon the N.C.G. level toward the side of sympathetic dominance and a red septum. Since the great majority of allergics have pale septa, indicating that their N.C.G. levels have been displaced toward parasympathetic dominance, phosphates are often more important in the relief of allergy than calcium. A certain amount of ionized calcium is necessary to prevent excessive capillary permeability but past this point calcium actually becomes harmful to pale septum people, exaggerating their muscular weakness and numbness of peripheral areas of the body. The clinical evidence to support this conception of calcium is not as clear as it is in reference to phosphates. Phosphates tend to produce a feeling of strength. Meats are high in phosphates and supply an excellent source. In milk the phosphates are largely balanced by calcium as calcium phos-

phate. Red septum patients are apt to need calcium and its absorption should be promoted by the concurrent use of Vitamin D. Since Vitamin D aids in the absorption of both calcium and phosphates, it is apparently indicated for both the red and pale septum patient. Newly formed cavities in the teeth may indicate calcium poverty.

Much consideration has been given iodine in the work of the Jarvis group but the author feels that for the present he would rather omit its discussion although its great importance is fully understood.

Iron, copper, manganese, mercury and arsenic, aside from the effect of some of them on the correction of anemia, are thought to be indicated to correct an N.C.G. shift to the side of parasympathetic dominance. In many ways sulphur and selenium can be paired off as their antagonist. It may be that the high sulphur content of eggs and onions may have some part in the frequent allergic symptoms following their absorption. If used at all in people with pale septa colloidal sulphur should be given with care to those who show an evidence of a shift to the side of parasympathetic dominance and a pale septum, otherwise distressing reactions will follow either its oral or intravenous use. If calcium exerts force toward the correction of sympathetic dominance calcium thiosulphate would seem preferable to sodium thiosulphate for those with an N.C.G. shift toward sympathetic dominance caused by an excess of the heavy metals. The old time use of sulphur in the spring to prevent infections will naturally be recalled by many.

In connection with arsenic as a force toward the production of sympathetic dominance, it should be noted that an excessive sodium intake predisposes to arsenical dermatitis and treatment should include such recognized sodium antagonists as potassium, calcium and magnesium.

If the vasodilatation accompanying certain atmospheric changes has been thought to have a beneficial effect upon syphilis, surely the same result, when produced by arsenic or mercury, would be likewise beneficial if they are used in sufficient doses to produce and maintain an N.C.G. shift toward the side of sympathetic dominance.

Magnesium and sulphur are of benefit to red septum patients and milk of magnesia after meals would probably have to be

taken in large quantities by those with an N.C.G. shift toward sympathetic dominance to produce purgation but any part which might be absorbed would have a corrective influence. Magnesium citrate might be selected for those with an N.C.G. shift toward sympathetic dominance with a similar thought in mind.

Strychnine is a drug which is indicated in some pale septum patients. But to the author the selection of the patients who should receive it seems difficult. The activating sparks to the adrenals, thyroid and probably other catabolic glands come through their sympathetic nerve supply and in patients without exhausted catabolic glands the use of strychnine, which increases the sympathetic impulses, is certainly of great benefit, at least temporarily while other slower factors are being built up. But with an N.C.G. shift to the pale septum side due to exhaustion or constitutionally inferior catabolic glands the effect of added sympathetic impulses is to prevent these glands from accumulating the reserve without which each emotional excess results in general prostration. A history of exacerbations of symptoms following emotional stress seems to the author to constitute a contraindication to the use of strychnine and an indication for the administration of a suprarenal extract prepared for oral administration in the hope of relieving the drain upon the suprarenals until they can accumulate a reserve. If they are constitutionally inadequate (an extreme example being Addison's disease) continued administration will be necessary as with insulin in diabetes.

Tablets containing atropine and quinine seem to help pale septum patients, atropine being one of our most potent sympathetic stimulants. Quinine would seem useless in the amounts contained in the usual rhinitis tablets but as a suprarenal stimulant the small quantity used does seem to be potent and theoretically correct. The suprarenal glands are particularly absorbent in reference to quinine and large doses result in suprarenal depression. Very small quantities of quinine must be used in people with an N.C.G. shift to the pale septum side to obtain suprarenal stimulation, being sure to avoid suprarenal depression, which would, of course, defeat the aim of the treatment. Pale septum patients are those who benefit most from the use of these tablets. Incidentally it would seem advisable to highly fortify quinine with suprarenal stimulants when

giving it for preventing or treating plasmodial infections. Alcohol in sufficient quantities is probably good. Small quantities of alcohol often overstimulate an overactive pancreas, resulting in an increase of hyperinsulinism which would still further submerge the depressed suprarenals.

Large quantities of quinine can be used in red septum patients in an attempt to relieve a "congested headache."

Large quantities of pepper and alcohol seem to favor a shift to the red side of sympathetic dominance and it is interesting to note the tendency toward a lower average basal metabolism in the tropics and the free use of pepper and alcohol by the white races inhabiting such lands, possibly in an unconscious attempt to prevent this shift caused by heat. Whether the heat or an excessive fruit and vegetable diet is responsible, or both, is a matter for speculation. Heat has been described as a suprarenal depressor to the point of death from diarrhea in the Far East[5] and on the other hand fruit and vegetables are almost certain to supply an alkaline diet. Jarvis reports that most of his patients in Vermont have red septa while those members of the group who live in the South report that most of their patients the year round show pale septa. If this observation is true, excellent medical therapy for acute rhinitis, for instance, in the East, may not be best in the South.

Nicotine from the glandular point of view seems to parallel quinine in its effect, small quantities stimulating the catabolic glands and large quantities depressing them. If it is remembered that increased blood sugar follows the eating of sweets and likewise the stimulation of the catabolic group of glands, the reason for the arrest of hunger after a meal, by smoking, is apparent. The effect of an after-dinner smoke would seem to be somewhat similar to that of a sweet dessert. Excessive smoking is probably harmful to pale septum patients with catabolic glandular insufficiency.

Peptone was reported in 1922[6] as causing an enormous increase in the salivary response to the parasympathetic stimulating drug, pilocarpine. The excitability of the vagus part of the parasympathetic system was shown in 1928[7] to be increased by the injection of foreign serum into an animal. In 1930[8] peptone injections were shown to increase the reactivity of the heart to pilocarpine.

These above researches would suggest that peptone and foreign serum are powerful parasympathetic stimulants and should be of great value to those with an N.C.G. shift to the side of a red septum. Clinically this seems entirely true. It is hard to believe that any doctor has failed to see the alarming effects of foreign proteins in their allergics, who usually already exhibit an N.C.G. shift toward a dominant parasympathetic system.

It has been customary to consider all foreign proteins as having identical effects. It seems to the author that this belief is subject to doubt, as a number of diseases in his practice have been seen to result in pale septa, and there are facts which suggest that other diseases may fall on the side of parasympathetic dominance. In his practice the clinical picture called influenza is associated almost invariably with a pale septum.

Upon comparing notes with others who live in the North Eastern States it was found that influenza patients (presenting the same clinical picture) showed red septa in most instances.

In closing, the following tentative grouping of diseases as to the apparent effects of their toxins is offered. Staphylococcic infections and streptococcic infections, up to a certain degree of severity, seem to tend to produce an N.C.G. shift toward the side of sympathetic dominance. Very severe streptococcic infection may produce signs on the side of parasympathetic dominance, such as urticaria, probably by suprarenal exhaustion. Atropic arthritis is said to be associated with and promoted by an N.C.G. shift to the side of sympathetic dominance.[9]

Migraine and epilepsy are frequently associated with an N.C.G. shift to the side of the pale septa.

Intestinal parasites not only are frequently associated with an N.C.G. shift to the side of the pale septum but there is often an increase in eosinophiles as in allergy.

Diphtheria and Vincent's angina are probably diseases associated with an N.C.G. shift to the side of parasympathetic dominance and pale septa. In connection with diphtheria, a pale septum disease, it is interesting to note that a persistent acid reaction interferes with the production of toxins[10] and if

sugar is present in broth in considerable quantity the acid produced by its fermentation hinders materially the accumulation of toxin. Broths free of muscle sugar are advantageous when producing toxin. Before the days of antitoxin clinicians[11] pinned their therapeutic faith to quantities of iron (now believed to be a red septum producing factor).

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210 Swift-Kyle Building.

DRY MOUTH, VILE TASTE, CALCULUS IN SUBMAXILLARY GLAND.

DR. PHILIP S. STOUT, Philadelphia.

I am reporting this case because it may help some other physician who has a similar case that may baffle him as this one baffled me.

Nearly 20 years ago this patient, Mrs. F. P. G., who was then about 40 years of age, came under my care, suffering with a dry mouth, most noticeable in the morning on arising and more on one side than on the other. No pain, no swelling, no indigestion; however, she was inclined to be a little nervous. Careful examination by myself and others failed to reveal any pathological condition that might account for her trouble. About 14 years ago she moved to another city several hundred miles away. However, I asked her and her husband to let me know if they found the cause or means of relief of her condition. Some 12 years ago she began to have a very vile taste which was particularly bad at mealtime. This was most exasperating. She consulted many specialists whose recommendations were many and varied; X-rays, removal of teeth, removal of tonsils, diet, rest, etc. All this was done but she had no relief. Some time later she had a very severe automobile accident, followed by a very stormy convalescence and nervous breakdown. After it was all over the vile taste was there just the same. It was as if it had been decreed that she should suffer with this everlasting bad taste. Then, in April, 1935, she had a swelling under her tongue for which she happened to consult a woman physician. The physician made a diagnosis of probable submaxillary calculi. "That very night," the patient writes me, "it came out in two pieces; one very small, the other" — she drew a circle about the size of a good sized shot to illustrate — "They just came out in my mouth without any squeezing on my part. I have had no bad taste since then, nor a dry mouth."

Needless to say that both she and her husband are very happy that this condition has been relieved at last.

269 S. 19th Street.

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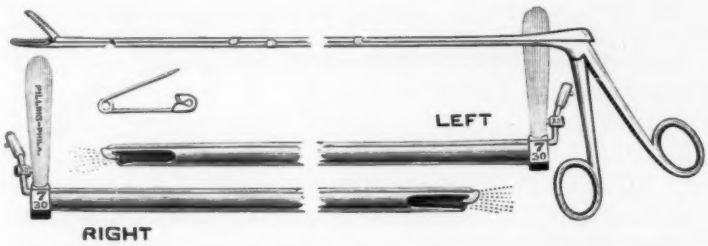
NEW INSTRUMENTS.

DR. JOHN D. KERNAN, New York.

SAFETY PIN ESOPHAGOSCOPE.

It is often very difficult in cases of open safety pins in food or air passages with the point up to get control of the point and bring it into the tube.

The tube herein described has been devised to make the securing of the point easier. It is made with a slot in the end opposite the light, with a hook at the extremity of the slot. The illustration makes this more understandable than any description can.



This Safety Pin Esophagoscope is used with a Yankauer or Little Alligator Forceps in the following manner: The mouth of the tube should be passed beyond the keeper-end with the open notch toward the point. When the ring is reached, the hook of the notch is engaged over the shaft of the pointed end. By withdrawing the tube somewhat, and, at the same time, rotating it towards the side on which the point lies, it will be found that automatically the point will come into the tube. When the pin is a small one, it is sometimes found that the whole pin rotates, making the engagement of the point impossible. If, when this happens, the ring is grasped by forceps and held firmly, it will be found possible to perform the

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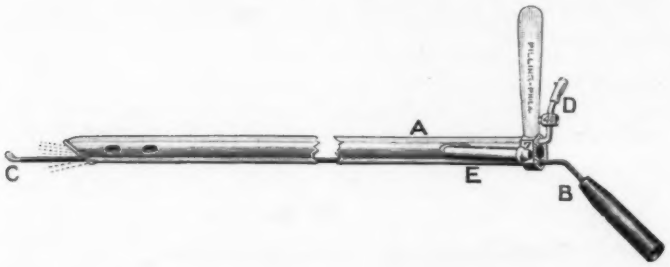
manipulation. Once the point is in the tube, the pin may be grasped by its ring end, and withdrawal is comparatively simple.

This Esophagoscope can be made up also as a bronchoscope, in varying sizes appropriate to the age of the patient and the sizes of the pin.

COAGULATING BRONCHOSCOPE.

In treating neoplasms of the bronchi by diathermy, it is necessary that the growth should be in sight during the whole time of the application of the current. This is not possible if the applicator is passed through the lumen of the tube.



Accordingly, the Coagulating Bronchoscope is made with an extra canal opposite that for the light carrier. The coagulator is inserted through this with its tip protruding into the lumen of the bronchoscope. This tip must be long enough to reach at least as far as the center of the bronchoscope, and may be plainly visible during the application to the neoplasm. The applicator should be long enough to reach 2 or 3 cm. beyond the end of the tube. Once the applicator is thrust into the growth and the current applied, the duration of the contact is controlled according to the effect produced, judged by direct vision.

These instruments are made by the George P. Pilling & Son Co., Philadelphia.

103 East 78th Street.

A NEW INSTRUMENT FOR TREATMENT OF PERITONSILLAR ABSCESS.*

DR. IRVING B. GOLDMAN, New York.

An eminent surgeon in a cynical vein has humorously compared the rhinologist incising a peritonsillar abscess to a hit and run driver — first you incise and then you run. An uncomplimentary analogy but not too far fetched. Since the procedure cannot be done with a satisfactory anesthetic, the surgeon, with a sick and painful patient in front of him who is unable to control himself, incises the abscess and tries to avoid becoming the receiver of the pus by artful dodging.

In addition there are dangers to the patient also, aspiration and a possible resulting lung abscess, hemorrhage because of anomalous distribution of vessels or necrosis of vessels, etc. As a result of these experiences, many surgeons aspirate first and when they feel safe, proceed to incise the abscess, following which the scalpel is withdrawn and an artery clamp or dressing forceps are inserted and the lips of the incision are spread open to permit more adequate drainage.

The management of peritonsillar abscesses can be facilitated by the use of the sharp-pointed lancet cannula (see Fig. 1) which can be attached to a suction apparatus. The spear-like end of the cannula (see Fig. 2) is inserted into the suspected abscessed cavity, the proximal end is then connected with suction and aspiration is begun. After the contents have been evacuated the cannula is slowly withdrawn. As the sharp end reaches the surface it is used as a lancet and converts the puncture into an incision in order to provide for more adequate and sustained drainage.

It has also been shown that this method is satisfactory for diagnostic purposes. Doubtful cases always present themselves and on several occasions, when the aspirations were negative, wider explorations were made with corroborative negative findings. Furthermore, in cases of peritonsillitis where inser-

*From the Laryngological Service of Mt. Sinai Hospital.

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tion of the instrument and suction resulted in no return of pus but only of blood, there was noted no spread of infection and abscesses did not develop. Instead, this procedure was followed by relief of pain such as is apt to follow incision of peritonsillar swellings with the relief of tension due to marked edema and congestion.

Fig. 1. Showing instrument about one-half size.

Fig. 2. Lower half of the cannula, showing the beveled spear-like end for entering the abscess.

Parapharyngeal and retropharyngeal abscesses can be treated in a similar manner. Here also the diagnostic aspirations may be of great value in avoiding complications of incision, particularly that of untoward hemorrhage.

Abscesses treated in this manner are easily evacuated and all the pus is aspirated. It is also extremely gratifying to find a clean pharynx after the abscess has been drained of its contents.

121 East 60th Street.

IN MEMORIAM

HERMAN B. MILLER

1878-1935

The sudden death of Dr. Herman B. Miller, of St. Louis, of septic pneumonia at the Jewish Hospital, Nov. 16, 1935, deprives the field of otolaryngology of an experienced and well-trained colleague and a man of cultural background as varied as it was rich. He was a linguist of unusual proficiency, interested in music and in nature and in these cults he found a keen enjoyment.

He was born in Canton, Mo., June 10, 1878, attending the elementary schools there. He was awarded a scholarship to Culver Stockton College, spent two years at the University of Missouri and graduated from Washington University School of Medicine in 1901. After three years of interneship at the City Hospital and the City Sanitarium he selected otolaryngology as his specialty, studied two years in Vienna and returned to St. Louis to engage in this specialty, registering for work in the clinic under the late Dr. Greenfield Sluder.

During the World War Dr. Miller held the rank of Captain in the Army Medical Corps. He served as otolaryngologist at the German Protestant Orphans' Home and at the Convent of the Good Shepherd. He was on the staff of the Jewish Hospital and the Deaconess Hospital.

In 1918, Dr. Miller was married to Miss Grace Lewis who, with two sons, survives him.

By disposition Dr. Miller was a man of reserve who found pleasure in quiet pursuits rather than along social lines. He was a constant reader and kept up his interest in English, German and French literature. E. W.

MINNESOTA ACADEMY OF OPHTHALMOLOGY AND OTO-LARYNGOLOGY.

SECTION ON OTO-LARYNGOLOGY.

Meeting of Feb. 8, 1935.

DR. FRED Z. HAVENS read his inaugural thesis on "Infections of the Neck" and showed numerous lantern slides.

DR. H. L. WILLIAMS read his inaugural thesis, entitled "Intranasal Operation for Chronic Maxillary Sinusitis; End Results in 200 Cases in Which the Principles of Küster Were Employed."

Summary of Paper: In 1889 Küster published his fundamental paper, "The Basic Principles of the Treatment of Suppuration in Rigid-Walled Cavities." He took the maxillary sinus as the example of a completely rigid-walled cavity with a lining of mucous membrane. He established as his principles of treatment an opening into the sinus large enough to allow inspection of the interior, and the removal of diseased portions of the membrane, polypi and sequestra, and the establishment of a permanent fistula to afford unobstructed drainage. It is on these principles that all later sinus surgery has been based. He chose as his route of approach the canine fossa.

In 1893, Caldwell, because of the extreme difficulty encountered in preventing reinfection of the antrum through the mouth with a permanent fistula present in the canine fossa, opened the antrum through the canine fossa, removed diseased tissue as advocated by Küster, and then made a permanent counter opening into the inferior meatus and allowed the opening in the canine fossa to heal.

In 1903, Luc advocated complete removal of the lining membrane of the sinus in addition to employing a technique similar to Caldwell.

In 1927, Hempstead described a technique of approach through the inferior meatus that met the requirements of Küster without sacrificing any of the functioning tissue of the nose and avoided the more troublesome approach through the canine fossa.

There are two methods that fulfill the surgical principles of Küster: First, the Caldwell technique; and, second, Hempstead's modification of the Mikulicz technique. The question of greatest moment in deciding which of these techniques to employ is the necessity of entire removal of the lining mucous membrane of the sinus as this can be accomplished only by the Caldwell technique.

Emerson, Kistner and Ferris Smith advocate the complete removal of the lining membrane on the ground that bacterial invasion of the submucosa is common and the sinus for this reason acts as a focus of infection. McGregor was unable to find evidence of bacteria in the mucous membrane. Ross could find no evidence of infection of the submucosa previous to surgical interference. Anderson was unable to demonstrate in 400 consecutive cases of chronic sinusitis that they had any effect as foci of infection.

Gorham and Bacher found evidence of formation of scar tissue bands in the sinuses following complete removal of the lining membrane. Mosher was of the opinion that this explained the number of unsatisfactory results obtained

with complete removal of the lining membrane. Lewis was of the opinion that removal of the mucosa produced a very marked cicatricial change in the basement membrane. The consensus of opinion seems to be against the removal of the mucous membrane lining. In our experience at the clinic, complete removal of the membrane has been unnecessary and we have, therefore, adopted the Hempstead technique as routine.

In operations on the maxillary sinuses by the intranasal route, Barlow, Tucker and Stevenson reported from mediocre to good results. Buckley was of the opinion that a good result from an intranasal operation depended upon a large intranasal opening. Goodyear was of the same opinion.

In our review 200 consecutive cases of chronic suppurative disease of the maxillary sinus, in which patients were operated on by various members of the staff during the year 1926, were selected because sufficient time should have elapsed to judge whether or not any good results obtained might be permanent.

In the group of cases in which an opportunity was afforded to observe the condition of the antrum after a lapse of from seven to eight years, a total of 115 operations was performed on 77 patients. In 31 of these cases the operation was bilateral, and in six cases subsequent operative procedures were found necessary.

In 45 cases, or 58.4 per cent of the total, gross changes, such as infected granulation or polypoid degeneration of the mucous membrane, were found in one or both antrums. In this group of 77 cases it was found that in 11, or 14.3 per cent, the results were for one reason or another unsatisfactory.

Of the remaining 123 cases who were not seen subsequent to operations, 104 reported that they had no symptoms suggesting sinus disease at the present time. In this group of cases, in 73, or 59.3 per cent, there were such gross changes as polypoid degeneration and infected tissue. In 27 cases bilateral operation was performed, making a total of 150 operations in 123 cases. It might also be of interest to note that in 52, or 25.5 per cent, of the 200 cases the infection in the antrum could clearly be attributed to extension of the infection from an apical abscess.

For the group reached by questionnaire, 19 cases out of 123, or 15.4 per cent, obtained unsatisfactory results. In other words, combining the figures in the two groups, 84.6 per cent received symptomatic relief.

In analyzing the cases for dissatisfaction in the whole group of 200 patients, it was found that in seven cases the probable error of failing to diagnose the presence of specific hypersensitiveness was the determining factor. In four cases bronchiectasis was present, and, although this number is too small from which to draw conclusions, it is suggested that bronchiectasis may be a factor in producing the sinusitis rather than the reverse. In two cases postoperative complications interfered with a good result; in one case, osteomyelitis of the maxilla; in the other, sphenoiditis. In six cases closure of the intranasal window resulted in failure, and in four cases in which the patients' replies did not furnish sufficient data to draw conclusions, failure probably resulted from this same cause. In two cases misdirected therapeutic efforts were the direct cause of continuance of symptoms, and in two others inadequate investigation failed to reveal the presence of a frontal sinusitis which maintained the infection in the antrum. In two cases failure to close the fistula from the alveolus to the antrum was apparently the cause of the difficulty, and in one case in which bilateral intranasal windows failed to relieve the nasal symptoms, bilateral Caldwell-Luc operations elsewhere eliminated such symptoms and apparently also caused marked improvement in arthritis from which the patient suffered.

Conclusions: 1. The surgical principles laid down by Küster are sound and accomplish the desired result.

2. Hempstead's modification of the Mikulicz and the Caldwell operations meets these requirements.

3. Failure to remove the mucoperiosteal lining of the sinus does not militate against a good result.

4. Good results of the operation depend on securing an adequate and permanent opening for drainage and on removal of diseased membrane.

5. Bad results are caused by failure to secure adequate drainage, incomplete investigation, failure in diagnosis, and poor selection of cases.

6. Cure can be obtained in about 80 per cent of cases of chronic maxillary sinusitis in which operation is by the intranasal route, as was evidenced by this study of 200 cases.

7. It is apparent, therefore, that the intranasal operation in the majority of cases gives such a satisfactory result that, except in exceptional cases, it should be the operation of choice.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of March 20, 1935.

An Observation on the Treatment of Osteomyelitis of the Skull with Report of a Case. Dr. Clarence H. Smith.

(Published in September, 1935, issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. S. W. GROSS (by invitation): The case which Dr. Smith has presented this evening demonstrates that perserverance and skill, along with meticulous attention to every small detail is essential for success in the treatment of diffuse osteomyelitis of the skull and its intracranial complications. Dr. Smith is to be congratulated for his ingenuity in using bacteriophage, not only to combat the systemic infection, but also topically at the site of the lesion. In this case following the use of bacteriophage the patient showed a dramatic improvement. A moribund patient was restored and his condition so altered that further necessary surgical treatment could be administered. To my knowledge, Dr. Smith's report is the first in which bacteriophage has been used locally in the treatment of osteomyelitis of the skull and brain abscess. Branch, Lempert and Lyman in 1934 reported beneficial results following the use of bacterial filtrates locally in badly contaminated severe cranocerebral injuries of warfare.

Dr. Smith has discussed the pathogenesis of diffuse osteomyelitis adequately. The distribution of the diploic veins usually delimits the disease to one system of veins. There are three sets of diploic veins in each lateral half of the skull; each forms a V with its apex downwards. The frontal system drains in the supraorbital vein. The temporal system drains into the sphenoparietal sinus and the lateral sinus. The occipital system drains into the lateral sinus or externally into the occipital vein.

In the cases which I have seen, diffuse osteomyelitis of the skull was most often secondary to disease of the frontal sinus. Furstenburg has emphasized the necessity for the radical excision of the infected bone well out into healthy bone. The method often employed by oto-laryngologists usually begins with an external frontal sinus operation. The necessity for the establishment of mass drainage, and later secondary suture often results in considerable scarring and deformity of the forehead which require plastic repair later. About six months ago I operated upon a boy, age 15 years, for diffuse osteomyelitis of the frontal bone secondary to empyema of the frontal sinus. A scalp flap was outlined so that almost the entire incision was in the hairline. The flap was reflected anteriorly, and after all the diseased bone was removed mass drainage was established, using packs saturated in acriflavine to keep the scalp flap away from the dura. When the wound was clean, secondary suture was done, and an excellent cosmetic result obtained. At a later date the boy showed signs of increased intracranial pressure and a large well encapsulated frontal lobe abscess was found and drained, and the patient is now on the way to recovery.

DR. WARD J. MACNEAL: I appreciate the privilege of addressing this Section. I think Dr. Smith is certainly to be congratulated on his results. The result here is probably due to a combination of three things: first, careful and

conservative surgery; second, good luck; and third, possibly the bacteriotherapeutic measures may have contributed to it.

In 1896, Mark Twain, while traveling around the world, came in India to the city of Agra on the Ganges river at just about the time when one of the government bacteriologists had observed that the water from the Ganges, when added to cultures of bacteria, would kill the cultures. This effect could be transmitted in this fashion, from one culture to another, indefinitely. With his interest in all scientific things, Mark Twain records this in his book, "Following the Equator," probably the first piece of writing in English that deals with this phenomenon. It was neglected, of course, after that. In 1915, F. W. Twort, in war service in England, studying the vaccine for smallpox, found that in his cultures of the vaccine, some of the bacterial colonies disappeared overnight. He was very much puzzled. If he touched a spot where one of these colonies had been and transferred that to another colony, the second colony also disappeared. He called this a transmissible disease of the bacteria. Since the agent causing this destruction passed through filters, he spoke of the phenomenon as a disease due to a filterable virus. Being in the army, he was then transferred elsewhere and was not able to do anything more with it.

In 1916, F. d'Herelle made clinical and bacteriological observations on Shiga dysentery. He found something in the stools of persons suffering from this disease which would dissolve the Shiga bacillus in cultures and the filtrates of these dissolved cultures brought about rapid recovery when fed to some of his patients. This remarkable observation seems to have been somewhat exaggerated in the description and it would appear that excessive enthusiasm has served to arouse opposition to bacteriophage therapy. D'Herelle gave this substance the French name of bacteriophage.

You are interested to know, I am sure, what this agent really is. I do not know, but I can illustrate to you what the phenomenon is. If a small amount of broth culture of colon bacillus is smeared over an agar plate and incubated one gets a confluent bacterial growth. When one adds a minute quantity of bacteriophage to the broth culture and then makes a precise similar smear on an agar plate, the culture develops with little holes in it like moth-eaten spots on a fabric. That is the bacteriophage phenomenon. It can be illustrated by two test tube cultures, to one of which the bacteriophage has been added.

The question arises whether this natural phenomenon can be of any use in the treatment of disease. This is, of course, a new research problem, which cannot be solved by test tube experiments.

If you inject staphylococcus aureus into the ear vein of a rabbit, and an hour later, a large dose of bacteriophage, and then kill the rabbit four or five hours later, you will find the cells in the liver loaded with phagocyted cocci. A control rabbit will also show this phagocytosis but to a lesser degree. The injection of bacteriophage into the blood stream causes rapid phagocytosis and relatively rapid disappearance of the cocci from the blood stream. If the bacteriophage rabbit is killed in 24 hours, you no longer see so many cocci in the Kupffer's cells of the liver because they are for the most part dissolved within the phagocytic cells. The control rabbit at this time will show more cocci remaining in the Kupffer cells. The bacteriophage, therefore, helps the body to dispose of the bacteria by the natural processes of phagocytosis and intracellular digestion.

I do not propose at this time to go into the application of this phenomenon to clinical medicine. However, I may say that our series of staphylococcus bacteremias now is well up to 160, and in that series, we have 45 recoveries. Bacteriophage is not a remedy to use against disease in any particular anatomical location of the body. It is a remedy to use against a specific microbe. You must know the microbe you are dealing with before you can use it. An etiologic diagnosis is required, rather than an anatomical diagnosis. The first step is to make a culture in order to know the microbe, and then apply the proper bacteriotherapeutic agent for that microbe. Wherever

the infection may be localized one may expect it to help fight that particular microbe. Bacteriophages are not substitutes for good surgery, but I think they offer an aid and a help to good surgery. Perhaps one may even say that they have become a part of good surgery.

A CLINICAL SYMPOSIUM.

I.—Two Cases of Early Carcinoma of the Larynx, and a Number of Cases of So-called Adenoma of the Bronchi, Apparently Cured by Diathermy. Dr. John Devereux Kernan.

II.—A Series of Cases of Total Laryngectomy for Cancer. Dr. Robert E. Buckley.

III.—A Series of Cases of Radical Mastoidectomy with Skin Graft. Dr. Daniel S. Cunning (by invitation).

IV.—The Present Status of Radical Sinus Surgery. Dr. E. Ross Faulkner.

(Published in October, 1935, issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. ARTHUR PURDY STOUT: During the past year, I have had the good fortune to have had available for study 12 of the so-called "adenomas" of the bronchi including four of the cases treated by Dr. Kernan, one of the cases reported by Wessler and Rabin, the case reported by Churchill and one of the cases reported by Rienhoff and Broyles. The others were unreported cases from the Massachusetts General Hospital and from Dr. Henry Louria, of Brooklyn.

Histologically these tumors are formed of anastamosing strands of epithelial cells which do not in my opinion form glands, have no epidermoid characteristics, no argentaffin granules and which very occasionally have droplets of mucin in their cytoplasms. Thus, they have almost no differentiating characteristics which would enable us to determine their cellular origin. Wessler and Rabin suggested an origin from the cells of the bronchial mucous gland ducts and Foot an origin from argentaffin cells. Neither of these hypotheses are based upon convincing evidence and at present their origin must remain a mystery.

They start in the submucous tissue of the main branch bronchi, usually early in life, grow very slowly, raising up the mucosa without involving it. They bleed easily and project into the lumen, partly obstructing it. If they become polypoid and mobile, as often happens, they are always found pointing toward the trachea. Sooner or later the tumor cells pass between the cartilaginous plaques and form small limited masses just outside the bronchus. In only the one case described tonight by Dr. Kernan has one of these tumors extended further out into the lung. No case has metastasized.

Treatment has not been attempted in many of the reported cases. Surgical incision through a bronchoscope has been reported by Kramer and Jackson and Jackson. Churchill has reported the removal of two lobes and Rienhoff and Broyles the removal of an entire lung for tumors which were supposed to be carcinomas but which are now known to be tumors of this type. All of these patients recovered and were without signs of persistence of the growth when last seen. The method of local destruction in situ used by Dr. Kernan should be more effective than simple excision because it has a better chance to destroy any prolongations of the growth outside of the bronchial cartilages, and the number of successful cases which he is reporting is incontrovertible proof of its value. Certainly it is greatly to be preferred to the major operation of removal of an entire lung. Even if the tumor should resist this form of treatment it is always possible to resort to lobectomy as a last resort. In my opinion Dr. Kernan has made an important contribution to the therapy of these tumors.

With regard to the tumors reported by Dr. Kernan as carcinomas of the larynx I have had an opportunity to study one of the sections recently. This showed, as you could see in the lantern slide, a marked proliferation of the mucosal cells which have changed their characteristics so that they appear like cancer cells but they have not, so far as this section is concerned, become separated from the surface and invaded the depths. Now such a picture may very well be found in a case of cancer but, unless the criteria of morphological change and infiltrative growth are both present in the biopsy, I do not believe that an unqualified diagnosis of cancer should be made. I feel, therefore, that Dr. Kernan has cured a lesion which may be cancer but which is not proved so by the biopsy.

DR. DUNCAN MACPHERSON: When a person is called upon to discuss these papers of Dr. Buckley and Dr. Faulkner, there is not very much to discuss. You do not get a chance to do any carping. There is not much fun in discussing a paper unless you can carp a little. These two gentlemen have covered the ground so very thoroughly, there is not very much for me to add.

Dr. Buckley speaks of a modification in postoperative treatment. Personally, in my cases I hardly ever begin a case and finish it in the way I expected to when I started. For instance, in a case of extrinsic cancer of the larynx, following the cue given by Dr. Buckley I removed the hyoid bone and then used diathermy, which latter was not his idea, I think, for removing the pharyngeal tissue, and then dressed in the usual way with tubes and so forth. I had another case in which I removed so much of the pharynx by diathermy that there was very little pharyngeal tissue left and that a portion of the posterior wall. There was likely to be a great deal of suppuration and I left the wound wide open. I did not bring the muscles together and I did not bring the skin together. I got a very good result. In that case I removed the excessive tissue with diathermy. In an intrinsic case, one in which I was interested a little while ago, we took a cue from Dr. Imperatori and closed the whole wound up entirely. The case did very well, and I understand that Dr. Imperatori's cases without any drainage tubes at all have done very well. The healing has taken place more rapidly and the patients get about more quickly than they do with the tube method.

We hear a great deal about loss of voice in these cases. Even an ophthalmologist will say he would rather die than lose his voice, yet he would not hesitate to take out both eyes. I would rather go through life without a voice than blind. The loss of the voice is not such a tremendous handicap. I have a case now, a barber, who carries on and does his work as well as he ever did. In fact, I think his customers like him better because he cannot talk and I think he is adding to his business all the time!

Dr. Faulkner did not refer to the ethmoids, I think. The ethmoid problem in sinus disease is one with which we are continually coming in conflict. We can in a measure divide them into different types. I think that we all feel in a case of polypoids or in a case where there is posterior ethmoid involvement or anterior and posterior ethmoid involvement, we need to do a radical intranasal operation. Personally, I think that there are very few cases in which, doing as radical an intranasal ethmoid operation as it is possible to do, we do not leave cells behind. I think it is the rule that you cannot remove all the cells by an intranasal operation except in unusual cases. That can be proved by doing as radical an intranasal operation as possible on a cadaver, and then doing an external operation to see how many cells there are left in. If you leave cells in a cadaver, where the cells are easily fractured and where the septa will break off easily with whatever instruments you are using to remove them, curettes or what not, it is still more difficult to eradicate them on the living patient because these cells are elastic, the septa are elastic and they will pull away or push away from the curette, and the only way to get them out is to punch them out and you cannot reach all of them with the punch. So when we do the intranasal radical operation, even in cases where there are no supraorbital cells or ethmofrontal cells or ethmomaxillary cells, I think even with the normal distribution of cells there will be a certain proportion of the usual five to 15 cells that will

be left in. There are cases of anterior ethmoidal disease that do not require internal radical operations. Some of my cases so treated are free from pus and scabbing and have better noses than have my more radical cases.

We all know that we do not have very many cases of frontal sinus external operations to do and have not had for many years. They nearly all get well by internal drainage. For a good many years in these cases I have been removing all the structures up to the floor of the frontal and then using a rasp with a smooth posterior surface, going up into the sinus and rasping forward. I have not done very much work with the forceps in that region, although I know some men do. It is very rare for me to find it necessary to do a radical frontal operation. I think the so-called Lynch operation may be suitable where a sinus is very small but believe its use is limited if I understand its technique.

Dr. Faulkner has covered the difficulties of the sphenoid operation so thoroughly that I do not think there is anything for me to add. He felt that the antrum work was so well known that he did not need to mention it. There is one point that I do not bring up as a discussion of Dr. Faulkner's paper but that I should like to bring out in regard to antrum work. When one does a radical antrum, I think all the membranes should be taken out. In this matter believing that macroscopically one can not differentiate between tissue that will and tissue that will not degenerate, I do not think it possible to do it macroscopically. I know that from my experience in this way. I give a good deal of leeway to the men in my clinic and on these borderline theoretical things I think they have about all the leeway they want. A good many antral cases were operated on radically and some of the men, feeling they could differentiate between healthy and unhealthy tissue and tissue that would and would not degenerate, left this apparently healthy tissue in the antra, leaving a large window under the inferior turbinate. Looking in within six weeks after such an operation I have seen large polypi, the membrane having continued to degenerate. Whatever the metabolism was that caused it in the first instance still continued, and the membrane went on degenerating. Therefore, I think in doing a radical antrum operation, we should take out the entire membrane.

DR. JOHN DEVEREUX KERNAN: I am glad that Dr. Buckley said a word about those two cases of laryngeal tumor. One of them, refusing cordectomy, went to another hospital. I wish you could have heard the excited comment that came to me from that hospital. The chief of service called me up and asked me if I was accustomed to removing normal cords by laryngofissure. He said they had looked into that larynx and saw nothing at all but normal looking cords. He wanted to know if I knew the patient had syphilis. How can an epithelial tumor come from syphilis? I told him to come up and look at the sections. His pathologist came up, and we have not heard any more from them. I cannot help feeling that those two patients are in great danger from those cords, because they did start something there in the epithelium, and they are still middle-aged, still using their voices, and still smoking, and they still have a tendency to carcinoma of the larynx. I think the doing of a cordectomy in both cases should be seriously considered, in spite of the fact that all the tumor tissue appears to have been removed at the time of doing the biopsy.

DR. DANIEL S. CUNNING: In answer to the question about the hearing after radical mastoidectomy, we are not accustomed to doing radicals unless the hearing is markedly diminished, and in practically all of our cases, the hearing was somewhat improved. If there is a fair amount of hearing present, say, anything over 25 or 30 per cent as shown by audiograms we try to get away with a modified radical. In three of our cases in which radicals had to be performed on children age 5, 8, and 10 years respectively, the hearing was decidely improved. In the youngest of the series a girl, age 5 years, whose hearing was down 70 per cent a radical and skin graft was done, and an audiogram taken three months later; there was but a loss of 10 per cent hearing.

It is hard to compare the hearing of radicals without skin grafts with those with skin grafts, but I feel the chances of improved hearing are better with the graft as we have a great many more dry cavities in the grafted cases.

DR. MARK J. GOTTLIEB: My impression was that the skin graft was originated for the purpose of perhaps preserving the hearing and avoiding scarring and contractures which might reduce the hearing after the radical mastoidectomy. Since the conditions in the country make it necessary for workmen to resume work as quickly as possible because of their economic condition, I believe that the skin graft certainly has a place. Dr. Cunning did not mention that he examined the hearing prior to his operation and after the operation. My experience has been that the skin graft does not necessarily preserve the hearing any more than the operation without skin graft. I have three cases in my records in which I have done audiometer readings before and following the operation, that is, after they were healed, without skin grafts, of course. Two were cholesteatomas and one a chronic petrositis. All three showed very nice improvement of hearing over that which I obtained at the beginning. It seems to me that the work that was done by Wever and Bray, Crowe and Gutman on the ossicles, relating to the depreciation of hearing in animals after disturbing the integrity of the ossicular chain, deserves a certain amount of revision of thought, because when we do a radical mastoidectomy we remove the ossicles except the stapes. Notwithstanding that fact, I have found that improvement of hearing can be obtained. There must be some regulatory or compensatory mechanism which comes in later with the healing process that allows for that improvement.

DR. ROBERT E. BUCKLEY: I was particularly interested in Dr. Kernan's first two cases of growths in the larynx. I think it is absolutely necessary to keep a very elastic mind as to what type of surgery should be done for a carcinoma of the larynx. I feel that if such cases occur as described by him, it certainly is theoretically possible that the condition might be cured by the simple removal of a large biopsy. I think if he had been given the opportunity, he would have done a laryngofissure in both cases, and I personally feel that would have been the safer procedure.

THE NEW YORK ACADEMY OF MEDICINE.

SECTION OF OTO-LARYNGOLOGY.

Meeting of April 17, 1935.

a. The Surgical Repair of Facial Nerve Paralyses. Dr. Arthur B. Duel.

b. The After Care of Surgical Repair of the Facial Nerve. Dr. Thomas G. Tickle.

DISCUSSION.

DR. ISADORE FRIESNER: I really have nothing to add to this presentation. Yet I cannot forego the privilege of expressing my appreciation of this work, not only from the scientific but also from the humanitarian point of view. I think it must have been an obstetrician who said that it is easy to conceive but hard to deliver. I do not believe even the first of these characterizations accurately applies to this work. I have known it from its inception and I do not know of any scientific endeavor that has been planned any more carefully than this, nor do I know of any effort in which the experimental basis for the clinical application has been more meticulously carried out than this. I believe that it has met with a well deserved and well earned success and I am sure you will agree with me in expressing unqualified admiration for this work.

DR. J. RAMSAY HUNT: We who have had to do with facial palsies these many years know only too well the operative difficulties which were encountered in the past. These were so great, and the results were so unsuccessful that they had been practically abandoned. I refer to the old operation of nerve transplant, in which an anastomosis of the hypoglossal or spinal accessory nerve was made with the facial, but after which the facial contortions were so great because of movements destined for the neck or tongue movements that the patient really gained nothing. Oftentimes he was worse off than before.

The operation which has been perfected by Sir Charles Balance and Dr. Duel is physiologically the perfect solution of the problem, and represents the attempt to bring about union in the facial nerve itself which brings the facial nucleus and its higher centers in direct relation with the muscles of the face.

With Dr. Friesner I have only the warmest words of commendation for the broad foundation which was laid for this research and the very careful way in which it has been carried out through experiments on animals and cautious application of the principles to human beings. It is a major contribution in the field of neuro-otology. Otology will claim its share of the honor because of the participation of Dr. Duel in this work and we neurologists will claim ours by virtue of Sir Charles, the eminent neurological surgeon.

It is perfectly clear that the operation is indicated in all severe operative injuries to the facial nerve which are encountered so frequently in otological work. You all know the end results of such cases when nothing has been done, and you had a demonstration this evening of what is possible by the Ballance-Duel method. Dr. Duel has pointed out that it can never be a perfect result, and that this really rests on the nature of the function of facial expression itself which is so definitely complex and fine.

Mention has been made of the relation of this operation to refrigeration or rheumatic palsies which we see so commonly in neurological practice. A large percentage of these cases are of the severe type and Dr. Duel has very pertinently raised the question of decompression of the nerve trunk in the Fallopian canal in this group of cases. They have demonstrated by their experimental work and I might say we know by operation on nerves elsewhere that a decompression, opening up the bony canal and slitting the sheath, does not in itself have any deleterious influence on nerve function, and may do a great deal of good. We have heard that in this series of 88 cases they have had no deaths, and there has been no injury to the auditory mechanism which is so near by. Although in the earlier cases there was some suppuration, even this did not militate against eventual restoration of function. Therefore, we can say that in good hands this operation is without danger, either to life or to the auditory apparatus. If we can detect these severe cases by early electrical examination and they can be decompressed and in that way saved a future deformity, it is certainly a cosmetic operation that many would be grateful for.

This is a question which in my judgment will have to be worked out by further study and observation. I do not think you will find many neurologists at the present time who would be willing to subject these cases of refrigeration palsy to operation on the present evidence. But further study may change this point of view, so that in the severe type of facial palsy decompression would be recommended.

Dr. Duel raised the question of my divisions of the neokinetic and paleokinetic functions and their physiological relation to this question. (The Dual Nature of the Efferent Nervous System. Arch N. & Psy., 1923, Vol. 10, p. 37.) Motility can be resolved somewhat schematically into reflex activity, represented in the spinal cord and medulla, which is the archeokinetic system; a paleokinetic activity which is under the control of the corpus striatum, and the striospinal system, and is some times called the extrapyramidal system. This system has to do with emotional expression, and such movements as walking, running and swimming; these are the so-called automatic-associated movements of the physiologist. The neokinetic system of movements is of much later development and is associated with higher cortical growth and development. All of these various types of movements are represented in facial motility. In diseased conditions these systems are often dissociated. The paleokinetic system I believe regenerates earlier than the neokinetic system. The neokinetic system follows and is a finer and more differentiated type of function. Therefore, in these recoveries we never expect to see a full return of the highest neokinetic type of function. In the operation under discussion, I understand that children so far have given the best results. In a child under the age of five years, the neokinetic system has not yet developed. The pyramidal tracts which convey the neokinetic function are not myelinized at birth. They gradually achieve their myelinization during the subsequent five years, so that if you were to operate on a child under that age, before the neokinetic system has developed and made its connections, it seems to me one might hope for a more perfect recovery.

I think the continuity of effort which the authors of this work have shown is admirable, and I think it is only a question of time when this will be a part of the armamentarium of every operating otologist. I hope also that the neurological surgeons will acquire the technique, because while I think it is more peculiarly an operation for otologists because of their great experience in the mastoid region and its finer relations to the auditory mechanisms, the neurologist and the neurosurgeon are naturally more likely to see the other types of facial palsy and they will be able to extend the range and importance of this operation which I think has a real future.

DR. ARTHUR B. DUEL: I wish to thank the gentlemen who have discussed the papers. They have been so flattering in everything they said about it. I only regret that Sir Charles Ballance is not here to share in the pleasure of hearing these remarks.

DR. CHARLES A. ELSBERG: I can only add, Mr. Chairman, that I thoroughly enjoyed Dr. Duel's presentation, and I admire his work.

c. Cribriform Plate (Olfactory Groove) Meningiomas and Their Early Diagnosis. Dr. Charles A. Elsberg.

(Published in September, 1935, issue of THE LARYNGOSCOPE.*)*

DISCUSSION.

DR. CORNELIUS G. DYKE (by invitation): At the Neurological Institute I have had an opportunity to work closely with the neurosurgeons and I can fully appreciate Dr. Elsberg's plea for an earlier diagnosis of these tumors. I have seen him remove several large olfactory groove meningiomas and when they attain a large size their removal is difficult and hazardous.

The Roentgenologist's interest in this subject is in an early diagnosis. By careful study of the plain Roentgenograms, a small hyperostosis arising from the cribriform plate of the ethmoid bone can be detected. This may vary in size from that of a pea to that of a walnut. Usually the hyperostosis is quite dense and has an irregular outline. It occurs in the vast majority of cases, particularly if the lesion is an old one.

The hope of making the diagnosis very early lies in encephalography. This method has been used successfully to diagnose small tumors arising from the tuberculum sellae and medial part of the sphenoid ridge and it may therefore be predicted that it will also give localizing evidence of small tumors arising from the meninges along the olfactory groove. These small tumors will undoubtedly produce deformities of the cisterna chiasmatis and interpeduncularis.

(Dr. Dyke showed a number of slides illustrating the size and shape of the normal basal cisterns and deformities produced in them by various small tumors.)

BOOK REVIEW.

Anatomical Revision of the Arterial System (Revision anatomica del sistema arterial) Vol. 1.—Technique (Tenica). By Dr. P. Belou, Buenos Aires, 1934.

This monumental book, which represents the work of many years of the author and his assistants at the Department of Anatomy of the Medical School of Buenos Aires, attempts a revision of the actual knowledge of the arterial system. The author emphasizes that the attempt to add new details to the previous work of several generations of anatomists is well-nigh purposeless. To pay a tribute to the men who gave the basis to the present knowledge, he includes at the end of the first volume a most complete list of books and papers dealing with the arterial system, and the methods for its study. The list includes 3,500 titles and certainly is the most complete ever published.

In collecting the list the author has rendered an invaluable service to future research. But this is certainly only a small part of the stupendous task he has accomplished.

The first volume of the book is dedicated to the discussion of the technical methods of study of the arterial system. After a summary description of the technique of injection of arteries and capillaries and a very interesting discussion of the photographic reproduction of the anatomic preparations, the author enters into the study of the radiologic technique. In short, the method consists in injecting the arteries with masses opaque to the X-rays and making stereoscopic Roentgenograms.

The work of previous investigators is fully considered in the first part of Article 4, Chapter III, while the rest of the article contains a minute description of the extensive researches of the author with many different masses of injection. He gives preference for the study of the arterial system, down to the precapillaries to gelatine masses. One mass is composed of sodium uranate 20 gm., and gelatine water 50 gm. The other mass contains a variable proportion of equal parts of mercury iodide, potassium iodide and water and of gelatine water. When the capillary net has to be injected soluble masses are necessary.

Chapter IV deals with the technique of stereoradiography as used in his department.

The preparation of the injected specimens for the radiography is minutely described in Chapter V. A radiography of the specimens *in toto* is often useless because of the complexity of the pictures obtained. As a rule it is necessary to reduce the size of the preparation, especially those of the head, thus making possible the photograph of only relatively simple territories. The photographs reproduced in this volume are very impressive and clearly demonstrate the usefulness of the radiologic technique for the analysis of the arterial supply either of large territories or of small organs. A photograph of the intact specimen is first made and later photographs of sections of it, each time trying to obtain an optical layer of the arterial net. Figs. 151 to 167 exemplify the technique followed in the study of the arteries of the head. Fig. 154 with the superficial arteries of the head; Fig. 160 with the meningeal arteries; Fig. 161 with the inferior maxillary artery; Figs. 165-167 with the internal maxillary artery and its branches, and Figs. 171 A and B with arteries of the ear deserve special mention.

The second volume contains an atlas (456 Figs.) of the arterial system of the head, neck, thorax and upper extremity, and the third volume an atlas (375 Figs.) of the abdominal and pelvic cavities and of the lower extremity. Although the greatest number of the illustrations are stereoradiographies there are also a great number of photographs of excellent standard preparation which greatly facilitate the study of the details revealed by the X-ray technique.

R. L. DE N.

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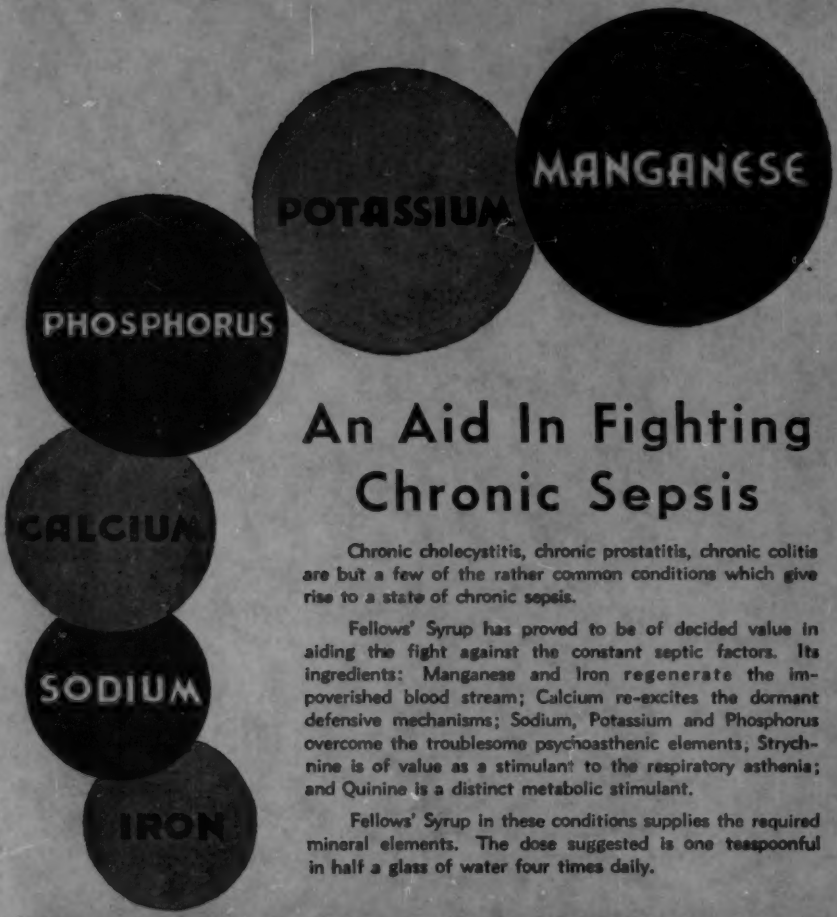

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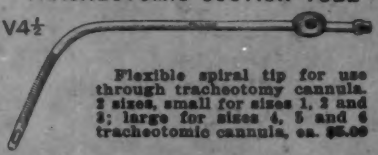

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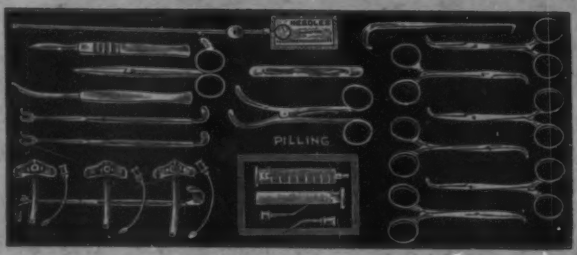

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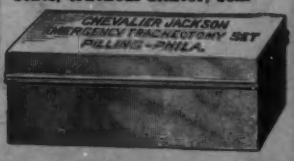

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